RULES
AND
REGULATIONS

1921-22

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LLOYD'S REGISTER OF SHIPPING.

RULES AND REGULATIONS.

REGISTER BOOKS AND PUBLICATIONS

ISSUED BY

THE COMMITTEE OF LLOYD'S REGISTER.

LLOYD'S REGISTER OF SHIPPING, issued annually in July. This Book contains the Names, CLASSES, and detailed information concerning the Vessels classed by Lloyd's Register and the late Underwriters' Registry for Iron Vessels; particulars, as far as possible, of ALL SEA-GOING VESSELS in the World, and of all iron and steel vessels trading on the North American Lakes, of 100 tons and upwards; the dead-weight capacity of Steamers and Motor Vessels; list of Motor Vessels; particulars of vessels fitted with Refrigerating Appliances; and lists of vessels carrying Petroleum in bulk; vessels fitted for Liquid Fuel, and Cable Steamers; together with a list of Owners of Ships recorded in the Register Book.

In the Appendix will be found lists of Subscribers arranged according to place of residence and alphabetically (in the former list descriptions of Subscribers' businesses are entered), details of Dry and Wet Docks, Floating Docks, Pontoons, Patent Slipways, Tidal Harbours, Quays, &c., in all parts of the World; a list of Telegraphic Addresses of all firms, &c., connected with Shipping (with the Telegraphic Codes severally employed), so far as ascertained; a list of Steamers of 500 tons and upwards arranged according to their gross tonnages; detailed Statistics respecting Merchant Shipping; lists of Shipbuilders, with names of existing Vessels built by each; list of fast Merchant Steamers; Index to Changes of Names of Vessels, &c., &c.

A list is also printed in the Appendix of the Members and Subscribers of Lloyd's, and of the Agents to Lloyd's.

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FOUNDED 1760. RE-CONSTITUTED 1834.

UNITED WITH THE
UNDERWRITERS' REGISTRY FOR IRON VESSELS IN 1885.

RULES & REGULATIONS

FOR THE

CONSTRUCTION AND CLASSIFICATION OF STEEL VESSELS.

CHANGES IN PRESENT EDITION OF THE RULES.

Amendments, which have been adopted by the Committee since the issue of the previous (1920–21) edition of the Rules, will be found in the following Sections :—

RULES AND REGULATIONS.

Section 7, Page 1. Section 17, Page 3.—A new Paragraph 5 added, and Pars. 5–13 re-numbered 6–14.
Section 29, Page 6.—Additional Formulæ. Section 32, Page 8.—Revised Scale of Freeboard Fees.

RULES FOR STEEL SHIPS.

Second and Subsequent Special Surveys No. 3, Page 18, Par. 7.
Section 49, Page 62.—The Rules for the Burning and Carrying of Oil Fuel have been re-written.

RULES FOR ENGINES AND BOILERS OF STEAM VESSELS.

Section 6, Page 78, Par. 1.—Discharge Valves. Section 15, Page 81, Par. 1.—Dampers.
Periodical Surveys.—Section 37, Page 96, Pars. 3, 7 and 15 amended ; a new Paragraph 12 added, and Pars. 12–17 re-numbered 13–18.

RULES FOR THE CONSTRUCTION AND SURVEY OF INTERNAL COMBUSTION ENGINES (OTHER THAN OF THE DIESEL TYPE) FOR MARINE PURPOSES.

These Rules have been revised throughout.

RULES FOR CONSTRUCTION AND SURVEY OF DIESEL ENGINES AND THEIR AUXILIARIES.

These Rules have been revised throughout.

RULES FOR ELECTRIC FITTINGS ON BOARD VESSELS.

Conductors.—Page 111, Pars. 4 & 5. Additions to Tables I–V. Scale of Fees.—Page 120.

EQUIPMENT FOR STEAMERS.

Table 31, Page 272.—Deletions from columns referring to Kedge Anchors.

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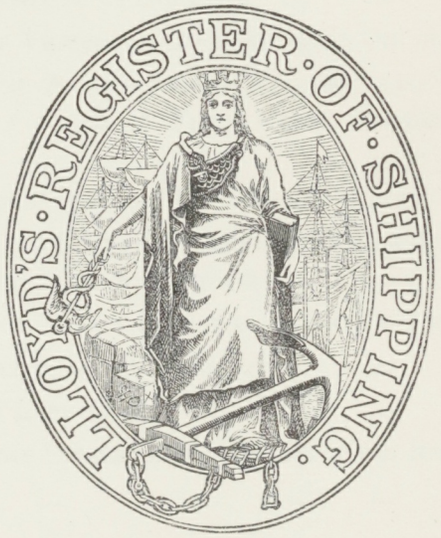

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Ship Surveyors ... ... — T. Shaw (*Principal Surveyor*), T. S. Leathard, W. S. P. Collings, J. Dickie, A. Pickworth, M.Sc.
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ASSISTANT ... ... H. JASPER COX

PRINCIPAL ENGINEER SURVEYOR ... ... E. M. SALMON

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J. Flockhart
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C. F. Macdonald

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Ship Surveyor ... ... D. Millar
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Ship and Engineer Surveyor F. W. Tweddell
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Ship Surveyor ... ... J. Hand
Surveyor for steel-testing duties ... ... J. H. Magoris
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Ship Surveyors ... ... W. Booth
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Ship and Engineer Surveyors — W. Butler, F. Adamson, W. Watters
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RIGA — *Ship and Engineer Surveyor* (Address, Bremerstrasse, No. 9, Riga) — *Eduard Buchholz

ESTHONIA.

REVAL — *Ship Surveyor* ... ... (Address, Raua tan, 8, krt. 3, Tallinn - Reval) — *Paul Gerretz

NORWAY.

BERGEN — *Ship and Engineer Surveyor* — *S. A. Eide (TELEGRAMS. *Surveyor*; TELEPHONE NO. *Hop*, 128)

CHRISTIANIA, *with a district extending from Fredrikshald to Lindesnæs*
Ship and Engineer Surveyor — P. B. Röli
Ship Surveyor ... ... — P. Eide, B.Sc. (TELEGRAMS, *Surveyor*; TELEPHONE NO. 6324)
(Office, Kirkegaden nr. 8, Christiania)

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Ship and Engineer Surveyors — O. A. Sunden, K. G. Anander

Ship Surveyors... ... ... — H. J. Thomson, J. H. Kay, Jr. (TELEGRAMS, *Surveyor*; TELEPHONE NOS. 4778 & 4798)
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Ship Surveyor... ... ... — F. R. Palmer (TELEGRAMS, *Register*; TELEPHONE NO. 1871)
(Office, Skeppsbron, 3, Malmö)

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Ship and Engineer Surveyors — A. F. Örbech, C. H. Kruhöffer, L. F. Klausen

Ship Surveyors ... ... — J. A. A. C. von Rosen, C. B. Scorer

CONSULTANT... H. J. SONNE, R.D.

(Office, Frederiksgade 12, Copenhagen, K.) (TELEGRAMS. *Engineer*; TELEPHONE NO. 5760)

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Ship and Engineer Surveyors — M. Koch, F. C. M. Witt, N. A. Stolte (TELEGRAMS, *Dykes, Steinhoft, Hamburg*; TELEPHONE, *Hansa*, 3335)
(Office, Steinhoft 3, Hamburg)

BREMEN, *with Bremerhaven, Emden and surrounding ports*... ...
Ship and Engineer Surveyor — G. H. C. Bahr (TELEGRAMS, *Bahr, Feldstrasse* 36; TELEPHONE, *Hansa* 759.)
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Ship and Engineer Surveyor — L. Hamelin
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Assistant Ship and Engineer Surveyor... ... ... — G. Esquerré
(Office, 8, rue de la République) (TELEGRAMS, *Lloydreg, Marseilles*; TELEPHONE No. 3093)

METZ
Surveyor for Steel-testing duties ... ... — *Jean Rebuffet

NANTES, *with all ports on the coast between Brest and Sables d'Olonnes*
Ship Surveyor ... ... — L. G. G. Démarest
Ship and Engineer Surveyor — G. A. Laing
(Office, 47, Quai de la Fosse, Nantes) (TELEPHONE No. 11-65)

ROUEN, *with a district including Dieppe*
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ST. ETIENNE
Surveyor for Steel-testing duties ... ... — *P. Renaud
(Address, 39, rue Mulatière)

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Ship and Engineer Surveyor — W. G. Vallis
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Ship and Engineer Surveyors (Office, Calle de Ibañez de Bilbao, No. 22) — W. G. McKinlay; C. H. Fowling (TELEGRAMS, *Register*; TELEPHONE No. 1342)

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Ship and Engineer Surveyor — H. Y. Bell
Ship Surveyor ... ... — A. Dalrymple Aitken
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GIBRALTAR
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Engineer Surveyor ... ... — *L. J. Stephens, C.B.E. (TELEGRAMS, *Yard*)
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SURVEYORS AT OTHER PORTS ABROAD—*continued.*

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PRAGUE	*Ship and Engineer Surveyor for steel testing duties* ... (Office, Vodickova 39IV., Prague II.)	C. R. Hughes (TELEGRAMS, *Surveyor, Prague*)

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MALTA	*Ship Surveyor*	*O. A. Payne
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MONTE VIDEO,	*including the ports of Paysandu and Sauce. Ship and Engineer Surveyor* (Address, Calle Zabala, 1531, Monte Video)	A. J. Matheson (TELEGRAMS, *Amphyl;* TELEPHONE NO. *Central* 1452)
PUNTA ARENAS, CHILI	*Ship and Engineer Surveyor*	
RIO DE JANEIRO	*Ship and Engineer Surveyor* (Office, Produce & Warrant Building, Avenida Rio Branco, 47; Caixa Postal 563)	J. C. G. Williamson (TELEGRAMS, *Surveyor, Rio*)
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SURVEYORS AT OTHER PORTS ABROAD—*continued.*

NORTH AFRICA.

ALGIERS	*Ship and Engineer Surveyor* (Office, 4, Boulevard de la République)	*Dewar Paton (TELEGRAMS, *Register*)

EGYPT AND RED SEA.

ADEN	*Ship and Engineer Surveyor* (Address, Hedjuff)	*T. W. Twaddle (TELEGRAMS, *Twaddle*)
ALEXANDRIA	*Ship and Engineer Surveyor*	
PORT SAID	*Ship and Engineer Surveyor* (Address, P.O. Box 2)	*J. Macvey (TELEGRAMS, *Macvey*; TELEPHONE NO. 546)

SOUTH AFRICA.

CAPE TOWN	*Ship and Engineer Surveyor* (Address, Thomson Watson's Buildings, Adderley Street)	*W. R. McArthur (TELEGRAMS, *Navigation*)
EAST LONDON	(Address, 38, Britannia Arcade)	*J. C. Morison (TELEGRAMS, *Register*)
PORT ELIZABETH	*Ship and Engineer Surveyor* (Address, Harbour Works)	*H. McG. Richardson (TELEGRAMS, *Richardson, Harbour, Port Elizabeth*)
PORT NATAL	*Ship and Engineer Surveyor* (Address, 3, Castle Buildings, West Street, Durban)	*John Stewart (TELEGRAMS, *Thrust, Durban*)

MAURITIUS.

MAURITIUS	(residing at Port Louis)	*K. S. Macdonald (TELEGRAMS, *Macdonald, Port Louis, Mauritius*)

INDIA, CEYLON, BURMAH, SIAM, AND STRAITS SETTLEMENTS.

BANGKOK	*Ship and Engineer Surveyor* (Office, Chartered Bank Lane)	*T. H. Pollard (TELEGRAMS, *Pollard*)
BOMBAY	*Ship and Engineer Surveyor* (Office, Datoobhoy Mansions, Mayo Road)	D. Macfarlane (TELEGRAMS, *Surveyor*; TELEPHONE NO. 3335)
CALCUTTA	*Ship and Engineer Surveyor* (Office, Temple Chambers, 6, Old Post Office Street)	T. W. C. Napier (TELEGRAMS, *Freeboards*)
COLOMBO	*Ship and Engineer Surveyor* (Address, Arcade Buildings)	*H. S. Melton
KARACHI	*Ship and Engineer Surveyor* (Address, Bunder Road, Karachi)	*F. H. Jones, M.B.E. (TELEGRAMS, *Surveyor*)
PENANG	*Ship and Engineer Surveyor* (Address, The Government Surveyor of Ships' Office)	*W. Mellor (TELEGRAMS, *Mellor*)
RANGOON	(Address, Lower Poozoondoung)	*R. P. Taylor (TELEGRAMS, *Orion, Rangoon*)
SINGAPORE	*Ship and Engineer Surveyor* (Address, 2, Laidlaw Building, Battery Road)	W. H. Fraser

EAST INDIAN ARCHIPELAGO.

BATAVIA	... ... (Address, Nieuw Prauwenveer)	*J. P. Boon
MANILA, P.I.,	*and ports in the Philippine Islands* ... ... *Ship and Engineer Surveyor* (Address, 129, Dasmarinas, Binondo, Manila)	*C. B. Nelson (TELEGRAMS, *Register*)
SOURABAYA	*Ship and Engineer Surveyor*	*B. N. Powell (TELEGRAMS, *Powell*)

HONG KONG.

HONG KONG	*Ship Surveyor* ... ... *Ship and Engineer Surveyor* (Office, 5, Alexandra Buildings, P.O. Box 463)	J. S. Gardiner T. S. Morrison (TELEGRAMS, *Marine*; TELEPHONE NO. 179)

CHINA.

DAIREN, MANCHURIA	*Ship and Engineer Surveyor* (Address, 5, Higashikonzecho)	J. Sim (TELEGRAMS, *Register*)
HANKOW	*Ship and Engineer Surveyors* (Address, British Municipal Chambers)	*H. R. Nielsen *D. A. Malcolm (TELEGRAMS, *Nielcolm, Hankow*)
SHANGHAI	*Ship and Engineer Surveyor* (Address, 7, Jinkee Rado)	H. L. Fletcher (TELEGRAMS, *Register*)
TIENTSIN	*Ship and Engineer Surveyor* (Address, Messrs. Borrows & Miller, Consular Road)	*A. J. Miller (TELEGRAMS, *Seaworthy, Tientsin*)

JAPAN.

KOBÉ	*Ship and Engineer Surveyors* (Office, Meikai Building) ACTING PRINCIPAL SURVEYOR ON THE CHIEF SHIP SURVEYOR'S STAFF. H. J. COX.	A. L. Jones, *Principal Surveyor for Japan.* R. O. Batchelor A. Watt H. D. Buchanan
	Ship Surveyors	S. I. Preston H. G. House
	Assistant Surveyor	Y. Jo (TELEGRAMS, *Register*)
NAGASAKI	*Ship and Engineer Surveyors*	A. S. Williamson W. Boylan
	Ship Surveyor ... ... (Office, 10, Sagarimatsu)	R. Crawford (TELEGRAMS, *Register*)
YOKOHAMA	*Ship and Engineer Surveyors*	J. S. Cairns F. G. Archbold A. Ewing T. G. Fry
	Ship Surveyor ... ... (Office, 167, Yamashita-cho; P.O. Box 48)	J. Crichton (TELEGRAMS, *Register*)
HAKODATE	*Assistant Ship and Engineer Surveyor* ... ... (Office, No. 2 Kaisho Machi)	*Zenzo Sato

KOREA.

KENJIHO	*Surveyor for Steel-testing duties*	W. Lawson

SURVEYORS AT OTHER PORTS ABROAD—*continued.*

AUSTRALIA AND NEW ZEALAND.

ADELAIDE, S. A. ... ... (Address, Institute Chambers, Divett Street, Port Adelaide) — *A. A. Fairweather (TELEGRAMS, *Fairweather*)

AUCKLAND, N.Z. ... ... (Office, 38, Richards-Upton Building, Custom Street East; Box 531) — *C. C. Plunket (TELEGRAMS, *Replento*)

BRISBANE, QUEENSLAND ... ... (Office, Parbury's Buildings, Eagle Street) — *R. S. Taylor (TELEGRAMS, *Surveyor*)

CHRISTCHURCH & LYTTELTON, N.Z.... ... (Office, 153, Hereford Street, Christchurch) — *C. A. Colonna (TELEGRAMS, *Kolona*)

DUNEDIN, N.Z. *Ship and Engineer Surveyor* (Address, 123, High Street) — *A. Morrison (TELEGRAMS. *Cellular*; TELEPHONE NO. 672)

FREMANTLE, W.A. ... ... (Address, Dalgety's Buildings, Cliff Street) — *R. E. Arundel (TELEGRAMS, *Arundel*)

LYTTELTON, N.Z. (*See* CHRISTCHURCH N.Z.)

MELBOURNE, VICTORIA *Ship and Engineer Surveyors* (Office, New Zealand Chambers, 483, Collins Street) — *Alexander McCowan, A. J. McCowan (TELEGRAMS. *Reports*; TELEPHONE NO. 3386)

AUSTRALIA AND NEW ZEALAND—*continued.*

NEWCASTLE, N.S.W. *Ship and Engineer Surveyor* (Office, 1, Bolton Street) — *F. A. Spence (TELEGRAMS, *Spence, c/o Barambio*; TELEPHONE, NOS. 1 & 873 *Newcastle*)

PORT PIRIE, S.A., *with Port Germein and Wallaroo* ... ... (Address, P.O. Box 20, Port Pirie) — *Alfred M. Mars (TELEGRAMS, *Mars*)

SYDNEY, N.S.W. *Ship and Engineer Surveyors* (Office, Bank of North Queensland Chambers, 251, George Street; G.P.O. Box No. 333) — A. C. Heron, W. Robertson (TELEGRAMS. *Miramar*; TELEPHONE, NO. 7227)

TIMARU, N.Z. ... ... (Address, Harbour Master, Timaru) — *Duncan McDougall

WELLINGTON, N.Z. *Ship and Engineer Surveyor*

71, *Fenchurch Street, London, E.C.* 3.
July, 1921.

LLOYD'S REGISTER OF SHIPPING.

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RULES AND REGULATIONS.

Section 1. This Society, founded in 1760 and reconstituted in 1834, was established for the purpose of obtaining for the use of Merchants, Ship Owners, and Underwriters, a faithful and accurate Classification of Mercantile Shipping, and for the government of which the following Rules and Regulations have been from time to time adopted.

Section 2. A Register Book to be printed annually for the use of Subscribers, containing the names of the Ships with other useful information, and the Character assigned, where the vessels are classed by the Society ; also the names, &c., of all Ships of 100 tons and upwards unclassed by this Society.

Section 3. Each person subscribing the sum of Six Guineas per annum (or such other sum as the General Committee may fix) to be considered a Member of the Society, and entitled *for his own use* to one copy of the Register Book.

Section 4. The subscription of Marine Insurance Companies, Public Companies or Public Establishments, to be Twelve Guineas per annum, for a single copy of the Register Book, and Six Guineas per annum for every additional copy supplied, unless the copies be periodically posted with type with additions and corrections throughout the year, in which case the subscription for each copy supplied will be Twenty Guineas per annum.

Section 5. In the case of other Subscribers, the subscription to be Six Guineas per annum for each copy, unless periodically posted with type with additions and corrections throughout the year, in which case the subscription will be Ten Guineas per annum for each copy supplied.

Section 6. For the convenience of Subscribers not resident in London, or whose Register Books are not posted, a Supplement, containing the additions to, and corrections made in, the Register Book, to be printed fortnightly, in such convenient form as to admit of its transmission by Post, so that such parties may be furnished, from time to time, with the latest and most complete information.

Section 7. The superintendence of the affairs of the Society to be under the direction of a Committee of Merchants, Ship Owners, and Underwriters (twenty-four elected in London and thirty-seven at the principal Outports), ten Shipbuilders and/or Engineers (elected by the General Committee), and any additional Members, not exceeding six, who may be elected by the General Committee. In addition, the Chairman, or, in his absence, the Deputy-Chairman, of the Corporation of Lloyd's, and the Chairman, or, in his absence, the Deputy-Chairman, of the London General Shipowners' Society, for the time being, to be, *ex-officio*, Members of the Committee ; also the Chairman of each Branch Committee established abroad to be, *ex-officio*, a Member of the Committee.

Any member (except an *ex-officio* member) who fails to attend any meetings of the Committee for a period of six continuous months, without leave of absence, shall cease to be a member, and his place shall be filled up in the usual way.

NOTE.—Official intimation to be given in June of each year whether the Chairman or Deputy-Chairman of the Corporation of Lloyd's, and the Chairman or Deputy-Chairman of the London General Shipowners' Society, are to be the *ex-officio* members for the ensuing twelve months.

Section 8. The General Committee reserve the right of varying or withdrawing the representation of Outports, and of Shipbuilders and Engineers; also the representation of Shipbuilders, Engineers, Steel Makers, and Forgemasters on the Technical Sub-Committee hereinafter mentioned, as well as the mode of election of members.

Section 9. 1. Six of the Members elected in London, namely, two of each of the constituent parts of the Committee, to go out annually by rotation, but to be eligible to be re-elected. The vacancies so arising to be filled up by the election of two Underwriters and one Merchant by the Committee of Lloyd's, and two Shipowners and one Merchant by the Committee of the London General Shipowners' Society.

2. Of the Members elected at the Outports twenty-one to retire at the end of four years, and seven of the Members elected at Liverpool and the nine Members elected at Glasgow to retire annually. The retiring Members are eligible for re-election.

3. The ten Shipbuilders and/or Engineers, and any additional Members, elected by the General Committee to retire at the end of four years. The retiring Members are eligible for re-election.

Section 10. The Committee to appoint Sub-Committees of Classification, to be so regulated that each Member of the General Committee may, in rotation, take his turn of duty thereon throughout the year.

Section 11. The Committee to appoint from their own body, annually, a Chairman and Deputy Chairman; and also a Chairman or Chairmen of the Sub-Committees of Classification.

Section 12. The Secretary, Clerks, and Servants of the Society, and the Surveyors, to be appointed by and be under the direction of the General Committee.

Section 13. Special meetings to be convened by order of the Chairman, or Deputy-Chairman or on the requisition of any three Members.

Section 14. All elections and appointments to be made by ballot, excepting when in the election of Chairman, Deputy-Chairman, or Chairman or Chairmen of the Sub-Committees of Classification, only one person is nominated for each office.

Section 15. No Member of the Committee to be permitted to be present on the decision of the classification of any ship of which he is the owner, or wherein he is directly, or indirectly interested.

Section 16. 1. The Committee to be empowered to make such Bye-laws for their own government and proceedings as they may deem requisite, not being inconsistent with the original Rules and Regulations under which the Society was established; but no new Rule or Bye-law to be introduced or any Rule or Bye-law altered, without special notice being given for that purpose at the Meeting of the Committee next preceding that at which such Motion is intended to be made; such notice to be inserted in the summons convening the meeting.

2. No new Rule, or alteration in any existing Rule materially affecting the classification of Ships, to be applied compulsorily to vessels of which the plans have been submitted and approved before the expiration of six months after the date when the change has been adopted.

Section 17. 1. That fifteen representatives of Shipbuilders, Engineers, Steel Makers, and Forgemasters shall be admitted as members of the Technical Sub-Committee on all occasions when it is proposed to make alterations in the existing rules, or to frame new rules, for the construction of ships or machinery.

2. That twelve representatives of Shipbuilders and Engineers shall be elected by the following bodies, viz. :

(*a*) The Institution of Naval Architects, London ;

(*b*) The North-East Coast Institution of Engineers and Shipbuilders, Newcastle-on-Tyne ; and

(*c*) The Institution of Engineers and Shipbuilders in Scotland, Glasgow,

two shipbuilders and two engineers being elected by each body ;

That two representatives of Steel Makers be elected by the Iron and Steel Institute, of whom one is to represent England and Wales, and the other Scotland ; also

That one representative of Forgemasters be elected by the English and Scottish Forgemasters' Association.

3. That the representatives shall be elected for a term of four years, but in the event of any vacancy occurring before the expiration of this period a representative may be elected to fill the vacancy for the unexpired portion of the term.

4. That those only who are actually partners in firms, or managers of joint stock companies, engaged in Shipbuilding, Engineering, Steelmaking, or the Manufacture of Forgings, shall be eligible for election.

5. That each Branch Committee of Lloyd's Register established abroad shall be entitled to nominate one of its Members as a representative at Meetings of the Technical Sub-Committee.

6. That additional members of the Technical Sub-Committee, not exceeding two, may be elected by the General Committee.

7. That the Chairman of the Committee of Lloyd's Register of Shipping, for the time being, or, in his absence, the Deputy-Chairman ; or, failing him, some other member of the General Committee shall preside at the meetings of the Sub-Committee.

8. That the representatives of Shipbuilders, Engineers, Steel Makers, and Forgemasters shall have the same rights and powers as the other members of the Sub-Committee in speaking and voting at the meetings of the Sub-Committee at which they are entitled to be present.

9. That it shall be open to representatives of Shipbuilders, Engineers, Steel Makers, and Forgemasters to propose alterations in, or additions to, the Rules for the construction of ships or machinery ; and that notice of all such proposals shall be sent in writing to the Secretary.

10. That meetings of the Sub-Committee shall be convened as often and at such times as may appear necessary to the General Committee, but there shall be at least two meetings in the year, though not necessarily one in each six months.

11. That every meeting shall be convened by notice from the Secretary at least one month before the date of meeting ; that the meetings shall, whenever practicable, be arranged for Tuesday afternoons; that notice of matters proposed to be brought before the Sub-Committee by members shall be sent to the Secretary not less than fourteen days before the meeting, and the Secretary shall, as soon as possible thereafter, send to each member an agenda paper.

12. That the recommendations of the Sub-Committee shall be reported to the General Committee, who will refer them for consideration to a Special Meeting of the General Committee, as required by Section 16 of the Rules.

13. That in the event of eight representatives of Shipbuilders, Engineers, Steel Makers, and Forgemasters, actually voting together on any question, and nevertheless failing to obtain a majority of the Sub-Committee, it shall be open to them to present a minority report to the General Committee.

14. That the General Committee reserve to themselves the right ot varying, adding to, or rescinding, at their discretion, any or all of the foregoing Rules.

Section 18. All Reports of survey to be made in writing by the Surveyors according to the form prescribed, and submitted for the consideration of the General Committee, or of the Sub-Committees of Classification ; but the character assigned by the latter to be subject to confirmation by the General Committee.

Section 19. 1. The reports of the Surveyors, and all documents and proceedings relating to the classification of ships are to be carefully preserved and to be open to the inspection of the Owners, but no other person or persons are to have access to such documents except with the written consent of the Owners and under the direction of the Chairman, or Deputy-Chairman.

2. Copies of the original reports (if the ships be already classed, but not otherwise), so far as relates to the dimensions, scantlings, fastenings, and materials, in cases where the correctness of the reports in these particulars is certified by the builders, are granted on application.

Section 20. Foreign ships, and ships built in the British possessions abroad where there is not a Surveyor (*see also* Section 52 of the Rules for Wood Vessels), to be surveyed on their arrival at a port to which a Surveyor has been appointed ; but a due regard is to be had to the circumstance ot such vessels having been exempted from supervision while building, and the Character to be assigned to them is to be regulated according to their intrinsic quality and from the best information the Committee can obtain.

Section 21. In every case in which the Character assigned to a ship may be proposed, on survey, to be reduced, notice is to be given in writing to the Owner, Master, or Agent, with an intimation that if the reduction be objected to, the Committee will be ready to direct a special survey, on the Owner, Master, or Agent agreeing to pay the expenses attending the same, provided on the said survey there shall appear sufficient ground for the proposed reduction.

Section 22. 1. When the Surveyors consider repairs to be requisite, they are respectfully to communicate the same in writing to the Owner, Master, or Agent, and if such repairs be not entered upon within a reasonable time, a corresponding report is to be made, as soon as possible, to the Committee for their decision thereon.

2. All repairs of Ships or Machinery required at Ports where there is a Surveyor to this Society, in order to their obtaining a Character in the Register Book, or to their retaining the Characters assigned to them therein, must be carried out under the inspection, and to the satisfaction of the Society's Surveyors. Ships or machinery repaired at Ports where there is no Surveyor to this Society must be surveyed by one of the Society's Surveyors at the earliest opportunity.

Section 23. Parties considering the repairs suggested by the Surveyor to be unnecessary or unreasonable may appeal to the Committee, who will direct a special survey to be held ; but should the opinion of the Surveyor be confirmed by the Committee, then the expense of such special survey is to be paid by the party appealing.

Section 24. The Surveyors to the Society not to be permitted (without the especial sanction of the Committee) to receive any fee, gratuity, or reward whatsoever for their own use or benefit, for any service performed by them in their capacity of Surveyors to this Society, on pain of immediate dismissal.

Section 25. The Surveyors will be directed to attend on Special Surveys of ships or machinery while building or under damage or repair, when required by Merchants, Shipowners, or Underwriters ; the charge for which is to be regulated according to the nature and extent of the service performed. In all cases, the application for the assistance of the Surveyors must be made in writing addressed to the Secretary.

Section 26. While the Committee use their best endeavours to ensure that the functions of the Society are properly executed, it is to be understood that neither the Committee nor the Society are under any circumstances whatever to be held responsible for any inaccuracy in any report or certificate issued by the Society or its Surveyors, or in any entry in the Register Book or other publication of the Society, or for any error of judgment, default, or negligence of the Surveyors, or other Officers or Agents of the Society.

FUNDS.

Section 27. The Funds to be under the authority and control of the Committee, and a statement of the Receipts and Expenditure to be annually printed for the information of the subscribers.

Section 28. The following Fees to be charged to the Owners of ships prior to their vessels being classed and registered in the book :—

Classing Fees.

For First Entry of Class in the Register Book.

For each Ship	under	250	tons gross	...	...	...	...	...	£2	0 0
Ditto	of	250	and under	500	tons gross	...	...	...	3	0 0
Ditto	of	500	„	1,000	„	...	...	...	4	0 0
Ditto	of	1,000	„	2,000	„	...	...	...	5	0 0
Ditto	of	2,000	„	3,000	„	...	...	...	6	0 0
Ditto	of	3,000	„	4,000	„	...	...	...	7	0 0
Ditto	of	4,000	„	5,000	„	...	...	...	8	0 0
Ditto	of	5,000	„	6,000	„	...	...	...	9	0 0
Ditto	of	6,000	„	8,000	„	...	...	...	10	0 0
Ditto	of	8,000	„	10,000	„	...	...	...	11	0 0
Ditto	of	10,000	tons gross and upwards			...	...	...	12	0 0

For First Entry of Notification of "LMC" in the Register Book.

For each Ship	under	100	nominal HP	...	...	...	...	...	£2	0 0
Ditto	of	100	and under	200	nominal HP	...	...	...	3	0 0
Ditto	of	200	„	300	„ HP	...	...	...	4	0 0
Ditto	of	300	„	500	„ HP	...	...	...	5	0 0
Ditto	of	500	nominal HP and above			...	...	...	6	0 0

SPECIAL SURVEYS.

Section 29. 1. For ships built under the special superintendence of the Surveyors (to entitle them to the distinctive mark ✠) :—2s. per ton for the first 1,500 tons gross ; 1s. per ton for every ton from 1,501 tons to 5,000 tons gross ; 6d. per ton for every ton from 5,001 tons to 10,000 tons gross and 3d. per ton for every ton beyond 10,000 tons gross. No fee to be less than £20.

50 per cent to be added to these fees for the Special Survey during construction of Vessels for Carrying Oil in Bulk.

2. For engines and boilers built under the special superintendence of the Surveyors (to entitle them to the distinctive mark ✠ in red) :—5s. per nominal horse-power for the first 250 horse-power ; 3s. for each horse-power from 251 to 500 ; 1s. for each horse-power from 501 to 1,000 ; and 6d. for each horse-power beyond 1,000. No fee to be less than £15.

The following rule is to be used for determining the Nominal Horse Power of Steam Reciprocating Engines in regulating the fees for their survey, viz. :—

$$\text{NHP} = \frac{\text{P} + 340}{1000}\left(\frac{\text{D}^2\sqrt{\text{S}}}{100} + \frac{\text{H}}{15}\right) \text{ where the boiler pressure is below 160 lbs.}$$

$$= \frac{\text{P} + 590}{1500}\left(\frac{\text{D}^2\sqrt{\text{S}}}{100} + \frac{\text{H}}{15}\right) \text{ where the boiler pressure is 160 lbs. or above.}$$

For determining the Nominal Horse Power of Steam Turbine Engines $\frac{\text{S H P}}{6}$ is to be substituted in the above formulæ for $\frac{\text{D}^2\sqrt{\text{S}}}{100}$, where S.H.P. is the Total Shaft Horse Power.

If the boilers are fitted with Forced Draught or Induced Draught appliances, then $\frac{\text{H}}{12}$ is to be taken instead of $\frac{\text{H}}{15}$.

where D = diameter of L.P. Cylinder in inches,
S = stroke in inches,
H = heating surface in square feet,
P = working pressure in lbs. per square inch.

The square feet of heating surface represented by H will comprise the surfaces of the tubes, of the back tube plate or plates, and of the furnace and combustion chamber plating down to the level of the fire bars.

The following rule is to be used for determining the Nominal Horse Power of Diesel Engines in regulating the fees for their survey, viz. :—

$$\text{NHP} = \frac{\text{N} \times \text{D}^2\sqrt{\text{S}}}{80} \text{ in the case of single-acting engines of the 4 cycle type,}$$

$$= \frac{\text{N} \times \text{D}^2\sqrt{\text{S}}}{40} \text{ in the case of single-acting engines of the 2 cycle type, and}$$

$$= \frac{\text{N} \times \text{D}^2\sqrt{\text{S}}}{20} \text{ in the case of double-acting engines of the 2 cycle type,}$$

where D = diameter of cylinder in inches,
S = stroke of piston in inches in ordinary reciprocating engines,
= twice the stroke of piston in the case of engines of the "Junker" type,
N = number of cylinders.

The following rule is to be used for determining the Nominal Horse Power of Internal Combustion Engines (other than those of the Diesel type) in regulating the fees for their survey, viz. :—

$$\text{N.H.P.} = \frac{\text{B.H.P.}}{3{\cdot}5}$$ where B.H.P. is the Brake Horse Power at full power.

For the survey and testing of steam boilers fitted in Motor vessels, additional fees will be charged in accordance with the Society's usual scale.

3. For the survey and testing of each Donkey Boiler, a fee of four guineas will be charged.

4. No charge will be made for occasional or docking surveys, at ports in the United Kingdom.

For the survey of damage repairs essential to the continuation of class (whether a special damage report be required or not), for the survey of repairs due to wear and tear when they are of an extensive character, for surveys with a view to the re-instatement of class, and for the survey of alterations in the structure of a vessel, a fee will be charged according to the nature and extent of the services performed.

For all surveys held at ports abroad a fee will be chargeable according to the nature and extent of the services rendered.

5. **SPECIAL PERIODICAL SURVEYS, Nos. 1, 2, and 3.**

For the special periodical surveys of Iron and Steel Vessels, when such surveys are held by the Society's exclusive Surveyors in the United Kingdom.

	S.S. No. 1.	S.S. No. 2.	S.S. No. 3.
	£ s.	£ s.	£ s.
For Vessels under 250 tons gross	5 0 ...	6 0 ...	8 0
,, ,, 500 ,, ...	7 0 ...	9 0 ...	12 0
,, ,, 1,000 ,, ...	9 0 ...	12 0 ...	15 0
,, ,, 2,000 ,, ...	12 0 ...	14 0 ...	20 0
,, ,, 4,000 ,, ...	14 0 ...	16 0 ...	21 0
,, ,, 6,000 ,, ...	15 0 ...	17 0 ...	22 0
,, ,, 8,000 ,, ...	16 0 ...	18 0 ...	23 0
,, ,, 10,000 ,, ...	17 0 ...	19 0 ...	24 0
,, over 10,000 ,, ...	18 0 ...	20 0 ...	25 0

Fees for second S.S. No. 1 and subsequent Special Periodical Surveys on hulls of vessels to be 25 per cent in excess of the above scale. Fees for Special Periodical Surveys of hulls of Vessels Carrying Oil in Bulk to be 50 per cent in excess of the fees chargeable for other vessels.

SPECIAL PERIODICAL SURVEYS OF MACHINERY.

Held at the Special Surveys, Nos. 1, 2, and 3.

For each Ship under 50 nominal HP.	£5 0 0
,, ,, 100 ,, ...	7 0 0
,, ,, 200 ,, ...	10 0 0
,, ,, 300 ,, ...	11 0 0
,, ,, 400 ,, ...	12 0 0
,, ,, 500 ,, ...	13 0 0
,, ,, 1,000 ,, ...	14 0 0
,, ,, 2,000 ,, ...	15 0 0
,, of 2,000 ,, and above	16 0 0

SPECIAL ANNUAL SURVEYS OF BOILERS.

To be held when and after the Boilers are six years old.

For each Ship having 1 single ended boiler	£2	0	0
And for each additional single ended boiler (including the donkey boiler)	1	0	0
But the fee in no case to be more than	10	0	0
For survey of donkey boiler of sailing vessels	2	0	0

In the cases of vessels fitted with double ended boilers, £1 to be added to the above scale for each double ended boiler, the maximum fee remaining at £10.

6. For Surveys for Restoration, Continuation, or the character A in Red, and in cases where the caulking of ships is superintended and tested by the Surveyors a charge will be made according to the nature and extent of the services rendered.

7. All repairs which may be required on the Surveys above referred to, must be performed under the superintendence of the Society's Surveyors. (*See also* Section 22.)

8. In all cases where travelling expenses are incurred by the Surveyors in connection with the above services, they are to be defrayed by the parties interested in the same.

Section 30. The class of a vessel is liable to be withheld, or, if already granted, may be withdrawn or expunged from the Register Book in the case of non-payment of any fees or expenses chargeable on account of such vessel.

Section 31. Certificates of Classification, signed by the Chairman, Deputy-Chairman, or Chairman of the Sub-Committee of Classification, and countersigned by the Secretary, will be granted on application.

FREEBOARD.

Section 32. Fees for the Survey for Certificate of approval of Load line, and assignment of, Freeboard.

	Classed Vessels.	Unclassed Vessels.
For Vessels under 100 tons gross	£2 0 0	£4 0 0
„ „ of 100 tons and under 300 tons gross... ...	2 0 0	6 0 0
„ „ 300 „ „ 500 „	3 0 0	8 0 0
„ „ 500 „ „ 1,000 „	4 0 0	11 0 0
„ „ 1,000 „ „ 1,500 „	5 0 0	14 0 0
„ „ 1,500 „ „ 2,000 „	6 0 0	17 0 0
„ „ 2,000 „ „ 2,500 „	7 0 0	20 0 0
„ „ 2,500 „ „ 3,000 „	8 0 0	23 0 0
„ every additional 1,000 tons up to 10,000 tons	1 0 0	3 0 0
„ „ „ 1,000 „ above 10,000 „	Nil	3 0 0

The same fee is to be charged for an unclassed wooden sailing or motor vessel whether opened out for survey or not.

The fee for the inspection of minor alterations involving an alteration of freeboard in a vessel having a valid load line certificate is two-fifths the full fee chargeable.

Section 33. Rules for Steel Ships, 5s.; if for Wood Ships and Composite Ships, 5s.

London, 21st April, 1921.

GENERAL REGULATIONS

RELATING TO THE

CLASSIFICATION OF STEEL VESSELS.

1. Classification. 1. *General.*—Steel vessels built in accordance with the Society's Rules and Regulations, or with alternative arrangements equivalent thereto, will be classed 100A so long as they are found, upon careful annual and periodical survey, to be in a fit and efficient condition for the safe conveyance of dry and perishable cargoes. Vessels which do not fully satisfy the requirements for the 100A class may, if the Committee approve, be classed 90A.

Deviations from the Rules will be allowed, provided they are submitted to the Committee and considered by them to be equivalent to the requirements of the Rules. The Builder is required to obtain the Owners' sanction to such deviations, when the Committee deem it to be necessary.

2. *Classes for Special Trades.*—Vessels which are intended for special trades or purposes, and which are considered by the Committee to be fit for the contemplated employment, will be classed A without a numeral prefixed, provided all the details of the proposed scantlings and arrangements are submitted to the Committee and approved by them, and provided the Rules are otherwise complied with. To the class A, in such cases, will be affixed notations showing the particular trades or purposes for which the vessels are intended, thus :- A "For river purposes only"; A "For tug purposes"; A "Fishing Smack"; A "For channel purposes"; &c. In the cases of vessels intended for channel purposes, the particular channel will be defined thus: "Bristol Channel," "Irish Channel," "English Channel," "Newhaven—Dieppe," &c.

Vessels built in accordance with the "Rules for the construction of vessels intended to carry oil in bulk," or that may be classed by the Committee for that purpose, will have the following notation inserted under their class in the Register Book—"Carrying petroleum in bulk."

3. *Vessels classed "with freeboard."*—In the cases of awning or shelter deck steamers and channel steamers, and, in such other cases as the Committee may consider necessary, it is a condition of classification that a minimum freeboard shall be submitted to and approved by the Committee. In such cases the words "with freeboard" will be inserted under the character in the certificates of class and in the Register Book, and the freeboard must be marked on the vessel's sides in the manner shown by the diagrams printed at the end of the Rules.

Whenever the character of a vessel to which a minimum freeboard has been assigned as a condition of classification is for any reason withdrawn or expunged from the Register Book, the record of freeboard will be omitted on the next reprint of the Register Book, unless the character has been previously reinstated.

2. Submission of Plans.—In all cases in which it is intended to build vessels for classification in the Register Book, sketches of midship section and profile, with deck and other plans, showing the proposed dimensions, scantlings and arrangements, must in the first place be submitted by the builders through the local Surveyors, for the approval of the Committee.

3. Special Survey during Construction.—Vessels intended for classification in the Register Book are to be built under the Society's Special Survey, and vessels so built will be entitled to the distinctive mark ✠ in the Register Book.

During the progress of construction, from the laying of the keel to the completion of a vessel, it is the duty of the Surveyors to examine the material and workmanship in order to ensure that the requirements of the Rules and the approved plans are satisfactorily carried out. The Surveyors are required to point out as early as possible anything that is objectionable, or that is not in accordance with the Rules or with the plans approved by the Committee for the particular vessel.

4. Vessels not built under Survey.—The requirements of the Committee in cases in which it may afterwards be desired that vessels which have not been built under the Society's survey should be assigned classes in the Register Book are set forth on page 61.

5. Engines and Boilers. 1. *General.*—The engines and boilers of steam vessels intended for classification, or already classed, in the Register Book, must be constructed under the Society's Special Survey. Appropriate records will be made in the Register Book in red ink, as follows, viz. :— ✠LMC. 6,17 (Lloyd's Machinery Certificate, June, 1917); ✠N.E.&B. 6,17 (New Engines and Boilers, June, 1917) ; ✠N.E. 6,17 ; or ✠N.B. 6,17. The requirements relating to the construction and survey of engines and boilers, are set forth on pages 77 to 96.

2. *Novel Types, &c.*—In cases in which the engines or boilers are of novel description, or in which experience has not sufficiently shown the safety of the principle or mode of application involved, the words " Machinery Experimental," or " Boiler Experimental," will be inserted under the class of the vessel in the Register Book ; but if, in the opinion of the Committee, the engines or boilers are so far inefficient as to imperil the vessel's safety, no class will be assigned.

6. Equipment.—The figure 1 placed after the character assigned to a vessel, thus :- 100A1 will denote that the vessel's equipment is in good and efficient condition and otherwise in accordance with the requirements of the Rules. In cases in which the requirements of the Rules as to equipment have not been complied with, or in which the equipment is found to be insufficient in quantity or defective in quality, a line will be inserted in place of the figure 1, thus:- 100A—.

7. Date of Build.—In all cases of vessels built under special survey, the date of the completion of such survey will be taken as the date of build of the vessel, provided the survey be completed within six months of the date of launching for vessels not exceeding 10,000 tons gross, nine months for vessels above 10,000 tons and not exceeding 20,000 tons gross, and twelve months for vessels above 20,000 tons gross. When, however, the special survey is not completed within the period allowed, the date of build will be taken as six, nine, or twelve months after the date of launching, as the case may be.

8. Periodical Special Surveys. 1. *General.*—To entitle steel vessels to retain the characters assigned to them in the Register Book, they are required to be subjected to the Periodical Special Surveys, designated No. 1, No. 2, and No. 3 (the requirements for which are set forth at pages 13 to 18). These surveys severally become due, in the cases of vessels classed 100A or 90A at 4 years, 8 years, and 12 years respectively from the date of build, and subsequently at the expiration of like periods from the date recorded in the Register Book of the previous Special Survey No. 3. Should a vessel at any time be submitted to Special Survey No. 3 before being 12 years old, the Special Surveys

subsequently required will be Nos. 1, 2 and 3, at 4 years, 8 years, and 12 years, respectively from the date recorded in the Register Book of such Special Survey No. 3.

2. *Vessels classed for special trades.*—Vessels classed A for special purposes are required to be subjected to Special Surveys Nos. 1, 2, and 3 (the requirements for which are set forth at pages 13 to 18), at 3 years, 6 years, and 9 years, respectively, from the date of build, and at the expiration of like periods from the date recorded in the Register Book of the previous Special Survey No. 3.

3. *Surveys held in anticipation.*—In cases in which it may suit the convenience of the owners, the Special Surveys Nos. 1 and 2 may be held at any time within twelve months previous to the dates at which they severally become due, and the Special Survey No. 3 may be held at any time before the date at which it becomes due.

4. *Period allowed for completion of surveys.*—In cases in which it is inconvenient to owners to fulfil all the requirements of either of the Periodical Special Surveys at the prescribed time, part only of the survey need be then carried out, provided the remainder of the survey be completed within twelve months from the date at which it became due. When a special survey is only partly held, the Surveyors must give the owners or their agents written notice of the parts not surveyed, and report the facts to the Committee.

5. *Record of Periodical Special Surveys in Register Book.*—Vessels which have satisfactorily passed any of the Periodical Special Surveys will have notations made against their names in the Register Book indicating the survey and the date at which it was held thus :—*ss*No.1–17, *ss*No.2–17, *ss*No.3–6,17, 2nd*ss*No.3–6,17. In cases in which Special Surveys are not completely carried out at one time, the date of Special Survey recorded in the Register Book will be the date of the survey at which the principal part of the requirements are complied with.

6. *Engines and Boilers.*—Particulars of the requirements for, and of the records made in the Register Book concerning the periodical survey of the engines and boilers of steam vessels, and of the donkey boilers of sailing vessels, are set forth at page 96.

9. Occasional Surveys.—All vessels are subject to Annual, or Occasional, Surveys when practicable. The requirements in respect of such surveys are set forth at page 18.

10. Survey of Repairs.—All repairs of vessels, engines and boilers that may be required at ports where there is a Surveyor to the Society, in order that the vessels may retain their characters in the Register Book, must be carried out under the inspection and to the satisfaction of the Society's Surveyor. When such repairs are effected at a port where there is no Surveyor to this Society, the vessel must be surveyed by one of the Society's Surveyors at the earliest opportunity.

When the Surveyors consider repairs to be requisite, they are respectfully to communicate the same in writing to the owner, master, or agent; and, if such repairs be not entered upon within a reasonable time, a corresponding report is to be made, as soon as possible, to the Committee for their decision thereon.

11. Notice of Surveys.—Whilst the Society's Surveyors are required to attend for the purpose of holding surveys in their district, the duty of giving notice when the attendance of the Surveyors is required to carry out Periodical Special Surveys or to supervise repairs rests with the owners, master, or agents. If such notice is not given, and the requisite surveys are not carried out, the characters of vessels are liable to be expunged from the Register Book.

12. Appeal from Surveyor's recommendations. — Interested parties considering the recommendations of the Society's Surveyors, as to the construction or repair of a vessel, to be in any case unnecessary or unreasonable, are entitled to appeal to the Committee, who will direct a special survey to be held ; but should the opinion of the Surveyor be confirmed by the Committee, the expense of such special survey is to be paid by the party appealing.

13. Certificates of Class. 1. *General.* — Certificates of first entry of classification, and certificates of character upon subsequent completed surveys on vessels, engines, and boilers, signed by the Chairman, the Deputy-Chairman, or the Chairman of the Sub-Committees of Classification, and countersigned by the Secretary, will be granted on application.

2. *Provisional Certificates.*—If the hull of a steamer has been built in accordance with the Rules, and a satisfactory report has been received from the Society's Surveyors, a provisional certificate will be issued, if desired, stating the class to which the vessel will be entitled when the engines and boilers have been fitted on board in accordance with the Rulès, and the Committee's requirements otherwise complied with.

14. Reconsideration of Class.—If, upon survey of any vessel, material reduction is found to have taken place in the thickness of the plating and angles, the classification of the vessel will be reconsidered by the Committee. In every case in which the class assigned to a vessel is proposed to be reduced, notice is to be given in writing to the owner, master, or agent, with an intimation that if the reduction be objected to, the Committee will be ready to direct a special survey, if the owner, master, or agent agrees to pay the expenses attending the same, provided on the said special survey there shall appear sufficient ground for the proposed reduction.

15. Withdrawal of Class. 1. *Non-compliance with Rules.* — When the Rules as regards surveys on the hull, engines or boilers of a steam vessel, or on the hull, masts, spars, or rigging of a sailing vessel have not been complied with, so that the vessel is not entitled to retain her class in the Register Book, the character will be expunged with a red line, under which the date of such withdrawal of class will be recorded.

2. *Reported defects.*—When it is found from reported defects in the hull, engines or boilers of a steam vessel, or in the hull, masts, spars, or rigging of a sailing vessel, that the vessel is not entitled to retain her class in the Register Book, the character will be expunged with a black line, under which the date of such withdrawal of class will be recorded.

3. *Owner's request.*—When the class of a vessel is withdrawn from the Register Book by the Committee in consequence of a request from the owner, the fact will be indicated by the insertion of three dots (...) in column 7 of the Register of steam vessels and column 8 of the Register of sailing vessels.

4. *Infringement of conditions as to minimum freeboard.*—If any vessel, to which a minimum freeboard has been assigned as a condition of classification, proceeds to sea with a less freeboard than that approved by the Committee, or if the freeboard mark is placed higher on the vessel's sides than the position assigned by the Committee, the vessel's class will be liable to be expunged from the Register Book.

PERIODICAL SPECIAL SURVEYS

OF

STEEL VESSELS.

SPECIAL SURVEY No. 1.

1. The vessel is to be placed on blocks of sufficient height in a dry dock or on a slipway ; proper stages are to be made ; and the holds and peaks are to be cleared for examination.

2. The limber boards and ceiling equal to not less than two strakes fore and aft on each side are to be removed, one such strake being taken from the bilges. Where the ceiling in the flat of bottom is fitted in hatches, the whole of the hatches and one strake of ceiling at the bilges are to be removed. At second and subsequent Special Surveys No. 1, additional ceiling is to be lifted at other parts of the vessel where deemed necessary by the Surveyor to enable him to satisfy himself as to the condition of the vessel.

3. The coal bunkers of steam vessels are to be cleared for examination, and ceiling is to be removed as in the holds. The bilges and limbers in the engine and boiler spaces are to be cleaned out, so as to allow of these parts being properly examined.

4. The framing and both surfaces of outside plating are to be exposed, and cleaned and coated where necessary. Special attention should be given annually to the examination of the ash shoots and the shell plating in way of the opening.

5. In cases in which the inner surface of the bottom plating is coated with cement or asphalt, the removal of this coating may be dispensed with provided it be carefully inspected, tested by beating or chipping, and found sound and adhering satisfactorily to the steel.

6. If the vessel has a double bottom, the ceiling is to be removed therefrom and the efficiency of the tanks tested by a head of water to the height of the light water-line. Where peak tanks or other deep water ballast tanks are fitted, their watertightness is to be tested by a head of water not less than 8 feet above the crown of the tank. All water ballast tanks are to be cleaned out, to admit of their being properly examined inside.

In the case of motor and other vessels burning liquid fuel and carrying it in the double bottom and other tanks, upon the occasion of the First Special Survey No. 1 these tanks need not be steamed out for internal examination, provided upon a general external examination of the tanks, the Surveyor finds the condition to be satisfactory. In these cases the tanks can be tested by a head of oil of not less height than that stated above.

7. When a deck originally required to be 4 inches thick is worn to 3 inches, $3\frac{1}{2}$ inches to $2\frac{3}{4}$ inches, 3 inches to $2\frac{1}{2}$ inches, it is to be renewed. If, however, such deck is found on survey to be in good condition, the case will, upon application, receive the consideration of the Committee.

8. The anchors are to be examined and placed in good condition, and when a vessel is undergoing Special Survey No. 1, after having passed Special Survey No. 3, the chain cables are also to be ranged for inspection; any length of chain cable which is found to be reduced in mean diameter at its most worn part to the extent indicated on the backs of Tables 30 and 31, is to be renewed; the windlass, if of wood, is to be unhung, where necessary, and its wood linings are to be sufficiently stripped for examination, unless this requirement was carried out at the previous Periodical Special Survey.

9. The masts, spars, and general equipment of steam and sailing vessels must be examined and found, or placed, in good and efficient condition. At second and subsequent Special Surveys No. 1, the mast and bowsprit wedging is to be removed, unless the plating of iron or steel masts and bowsprits is doubled in way of the same.

10. The hatches throughout are to be examined in position at the hatchways, and, if defective, are to be renewed or made good. The ventilator coamings and covers are to be examined, and special care is to be taken to see that they are in an efficient condition.

11. The steam steering engine and its connections, the steering rods, chains, blocks, rudder quadrant, tillers, steering gear, windlass, pumps, sluice valves, watertight doors, and air and sounding pipes are to be carefully examined, and the condition of the same is to be stated on the Surveyor's report. The Surveyor must see that doubling plates are fitted under all sounding pipes.

12. Where holds are insulated for the purpose of carrying frozen or chilled meat, and the vessel in way of the insulation was examined by the Society's Surveyors at the time such insulation was fitted, it will be sufficient at the first Special Survey No. 1 if the limbers and hatches are removed and the vessel is examined in way of the same. At all subsequent Special Surveys No. 1, in addition to the above, sufficient lining is to be removed in each of the chambers to admit of the framing and plating being exposed to satisfy the Surveyor of their general condition, subject to such modifications as may be accepted by the Committee, upon application in each particular instance.

13. The engines and boilers of steam vessels and the donkey boilers of sailing vessels must be examined and favourably reported on by the Society's Engineer Surveyors. For Periodical Surveys of engines and boilers, see page 96.

SPECIAL SURVEY No. 2.

1. The vessel is to be placed on blocks of sufficient height in a dry dock or on a slipway; proper stages are to be made, and the holds and peaks are to be cleared for examination.

2. The limber boards and ceiling equal to not less than three strakes fore and aft on each side are to be removed, one such strake being taken from the bilges. Where the ceiling in the flat of bottom is fitted in hatches, the whole of the hatches and one strake of ceiling at the bilges are to be removed. At second and subsequent Special Surveys No. 2, additional ceiling is to be lifted at other parts of the vessel where deemed necessary by the Surveyor to enable him to satisfy himself as to the condition of the vessel.

3. The coal bunkers of steam vessels are to be cleared for examination, and ceiling is to be removed as in the holds. The bilges and limbers in the engine and boiler spaces are to be cleaned out, so as to allow of these parts being properly examined.

4. The framing and both surfaces of outside plating are to be exposed, and cleaned and coated where necessary. Special attention should be given annually to the examination of the ash shoots and the shell plating in way of the opening.

5. In cases in which the inner surface of the bottom plating is coated with cement or asphalt, the removal of this coating may be dispensed with provided it be carefully inspected, tested by beating or chipping, and found sound and adhering satisfactorily to the steel.

6. If the vessel has a double bottom, the ceiling is to be removed therefrom, and the efficiency of the tanks tested by a head of water to the height of the light water-line. Where peak tanks or other deep water ballast tanks are fitted, their watertightness is to be tested by a head of water not less than 8 feet above the crown of the tank. All water ballast tanks are to be cleaned out, to admit of their being properly examined inside.

7. When a deck originally required to be 4 inches thick is worn to 3 inches, $3\frac{1}{2}$ inches to $2\frac{3}{4}$ inches, 3 inches to $2\frac{1}{2}$ inches, it is to be renewed. If, however, such deck is found on survey to be in good condition, the case will, upon application, receive the consideration of the Committee.

8. The chain cables are to be ranged for inspection, and the anchors examined and put in good working condition ; any length of chain cable which is found to be reduced in mean diameter at its most worn part to the extent indicated on the backs of Tables 30 and 31, is to be renewed. The windlass, if of wood, is to be unhung, where necessary, and its wood linings are to be sufficiently stripped for examination, unless this requirement was carried out at the previous Periodical Special Survey.

9. The masts, spars, and general equipment of steam and sailing vessels must be examined and found, or placed, in good and efficient condition. At second and subsequent Special Surveys No. 2, the mast and bowsprit wedging is to be removed, unless the plating of iron or steel masts and bowsprits is doubled in way of the same.

10. The hatches throughout are to be examined in position at the hatchways, and, if defective, are to be renewed or made good. The ventilator coamings and covers are to be examined, and special care is to be taken to see that they are in an efficient condition.

11. The steam steering engine and its connections, the steering rods, chains, blocks, rudder quadrant, tillers, steering gear, windlass, pumps, sluice valves, water-tight doors, and air and sounding pipes are to be carefully examined, and the condition of the same is to be stated on the Surveyor's report. The Surveyor must see that doubling plates are fitted under all sounding pipes.

12. Where holds are insulated for the purpose of carrying frozen or chilled meat, and the vessel in way of the insulation was examined by the Society's Surveyors at the time such insulation was fitted, it will be sufficient at the first Special Survey No. 2 if the limbers and hatches are removed and the vessel is examined in way of the same. At all subsequent Special Surveys No. 2, in addition to the above, sufficient lining is to be removed in each of the chambers to admit of the framing and plating being exposed to satisfy the Surveyor of their general condition, subject to such modifications as may be accepted by the Committee upon application in each particular instance.

13. The engines and boilers of steam vessels and the donkey boilers of sailing vessels must be examined and favourably reported on by the Society's Engineer Surveyors. For periodical Surveys of engines and boilers, see page 96.

SPECIAL SURVEY No. 3.

To be held by two Surveyors, one at least to be an officer of the Society.

1. The vessel is to be placed on blocks of sufficient height in a dry dock or on a slipway ; proper stages are to be made ; and the holds and peaks are to be cleared for examination.

2. All close ceiling is to be removed, so that the flat of bottom may be thoroughly examined. The whole of the frames, stringers, hooks, floor-plates, keelsons, engine and boiler bearers, ends of beams, water-tight bulkheads, rivets and inner surfaces of the outside plating are to be exposed. Where side lights are fitted, the condition of the plating in way of the same is to be ascertained. In iron and steel steam trawlers and other fishing vessels in which close ceiling is fitted at the sides of the holds above the bilges, provided a strake of this close ceiling be removed at the upper turn of bilge and another at the upper part of the side of the vessel, right fore and aft of the holds on both sides, and the condition of the iron or steel work of the shell plating, frames, reverse frames, &c., is found to be satisfactory, the removal of the remainder of the close ceiling above the bilges may be dispensed with. Whenever the close ceiling of these vessels is renewed, the Surveyor should report upon the condition of the iron or steel work in way of same.

3. The coal bunkers of steam vessels are to be cleared for examination and all ceiling is to be removed as in the holds. The bilges and limbers in the engine and boiler spaces are to be cleaned out, so as to allow of these parts being properly examined.

4. All rust is to be cut or beaten off the steel and iron throughout the vessel. The plank sheers and waterways, if of wood, are to be scraped bright. When the vessel is thus prepared, the Surveyors are to satisfy themselves thoroughly as to the condition of the plating. Special attention should be given annually to the examination of the ash shoots and the shell plating in way of the opening. If the Surveyors deem it necessary, the thickness of the plating is to be ascertained by drilling holes in parts to be indicated by them, and in such cases a detailed statement of the thicknesses is to be included in the Surveyors' report. Any parts that are found defective, or materially less in substance than is required by the Rules, are to be removed and replaced with proper materials, equal in substance and quality to that used in the original construction of the vessel. All the scaled or chipped surfaces of the iron and steel are to be recoated. The plank sheers, waterways, flat of decks and their fastenings, are also to be examined and made good where necessary. Where the deterioration in thickness is wide-spread, and it is not deemed advisable by the owner to renew the material, a detailed report is to be made by the Surveyors, and the class of the vessel will be reconsidered by the Committee.

5. In cases in which the inner surface of the bottom plating is coated with cement or asphalt, the removal of this coating may be dispensed with provided it be carefully inspected, tested by beating or chipping, and found sound, and adhering satisfactorily to the steel.

6. If the vessel has a double bottom, the ceiling is to be removed therefrom and the efficiency of the tanks tested by a head of water to the height of the light water-line. Where peak tanks or other deep water ballast tanks are fitted, their watertightness is to be tested by a head of water not less than 8 feet above the crown of the tank. All water ballast tanks are to be cleaned out, to admit of their being properly examined inside.

7. When a deck originally required to be 4 inches thick is worn to 3 inches, $3\frac{1}{2}$ inches to $2\frac{3}{4}$ inches, 3 inches to $2\frac{1}{2}$ inches, it is to be renewed. If, however, such deck is found on survey to be in good condition, the case will, upon application, receive the consideration of the Committee.

8. The chain cables are to be ranged for inspection, and the anchors examined and put in good working condition ; any length of chain cable which is found to be reduced in mean diameter at its most worn part to the extent indicated on the backs of Tables 30 and 31, is to be renewed. The windlass, if of wood, is to be unhung, where necessary, and its wood linings are to be sufficiently stripped for examination, unless this requirement was carried out at the previous Periodical Special Survey.

9. The masts, spars, and general equipment of steam and sailing vessels must be examined and found or placed, in good and efficient condition. All mast and bowsprit wedging is to be removed, whether the plating of iron or steel masts and bowsprits is doubled in way of the same or not. Iron or steel masts, bowsprits, and yards are to be carefully tested by hammering ; and if the plates are considered by the Surveyors to be materially wasted at any part, the thickness is to be ascertained by drilling. In sailing vessels, the standing rigging is to be lifted and the service and parcelling stripped off the nips, bends, and splices for examination ; if, however, the rigging has been recently lifted, particulars of the case are to be submitted for the consideration of the Committee. The bobstay pins, the deadeyes, and rigging screws to the whole of the standing rigging, also all bolts or pins and fittings, are to be carefully examined.

10. The hatches throughout are to be examined in position at the hatchways, and, if defective, are to be renewed or made good. The ventilator coamings and covers are to be examined, and special care is to be taken to see that they are in an efficient condition.

11. The steam steering engine and its connections, the steering rods, chains, blocks, rudder quadrant, tillers, steering gear, windlass, pumps, sluice valves, watertight doors, and air and sounding pipes are to be carefully examined, and the condition of the same is to be stated on the Surveyors' report. The Surveyors must see that doubling plates are fitted under all sounding pipes.

12. Where holds are insulated for the purpose of carrying frozen or chilled meat, and the vessel in way of the insulation was examined by the Society's Surveyors at the time such insulation was fitted, the limbers and hatches are to be lifted, and enough lining is to be removed in each of the chambers to admit of the framing and plating being exposed to satisfy the Surveyors of the general condition of the same.

13. The engines and boilers of steam vessels and the donkey boilers of sailing vessels must be examined and favourably reported on by the Society's Engineer Surveyors. For Periodical Surveys of engines and boilers, *see* page 96.

Second and subsequent Special Surveys No. 3.—Additional Requirements.

1. The Surveyors are to ascertain whether the scantlings of the vessel are satisfactorily maintained in all parts.

2. In steamers, the inside of the bunkers and the parts in way of the boilers are to receive the Surveyors' particular attention, in view of the special liability of these parts to deterioration.

3. The outside plating is to be drilled at such parts as the Surveyors may consider necessary to satisfy themselves as to its thickness, the number of holes drilled on each side of the vessel being in no case less than *three in each strake* of plating not covered with cement. All paint as well as rust is to be entirely removed before the plates are gauged, and the actual thicknesses at all parts drilled are to be correctly ascertained and stated on a sketch which is to accompany the Surveyors' report.

4. The plating in way of cement in the bottom need not be drilled, provided the cement be found to be adhering satisfactorily to the plating, and the Surveyors consider drilling at this part unnecessary.

5. In cases in which a Second Special Survey No. 3 is held on a vessel before she is 24 years old, the drilling of outside plating referred to in paragraph 3 may be postponed until she reaches that age ; but, until the requirements as to drilling have been fully complied with, the survey, in such cases, will be described in the Register Book as Special Survey No. 3.

6. In cases in which the requirements of the Second Special Survey No. 3 are fully complied with before a vessel is 24 years old, the fact will be noted in the Register Book. Such notation, however, will not exempt a vessel from compliance with the requirements of the survey as regards drilling when she is 24 years old, or at the first Special Survey held after that time, unless the drilling has been done at the previous Special Survey.

7. Where holds are insulated for the purpose of carrying frozen or chilled meat, and the vessel in way of the insulation was examined by the Society's Surveyors at the time such insulation was fitted, the limbers and hatches are to be lifted, and enough lining is to be removed in each of the chambers to admit of the framing and plating being exposed to satisfy the Surveyors of the general condition of the same and to enable the shell plating to be drilled as required by the Rules.

ANNUAL OR OCCASIONAL SURVEYS OF STEEL VESSELS.

At annual or occasional surveys, vessels should be examined generally, as far as possible.

When a vessel is placed in dry dock or on a slipway the Society's Surveyors at the port are to avail themselves of the opportunity to examine the bottom of the vessel, and to examine the vessel throughout as far as practicable in order to satisfy themselves generally as to her condition. Special attention should be given annually to the examination of the ash shoots and the shell plating in way of the opening, and to the condition of the hatchways, ventilators, and other openings in the decks.

Whenever the engines or boilers are taken out, the bearers, with the floor plates, keelsons, rivets, etc., under them, are to be surveyed ; and whenever the bottom plating is to be cemented, a survey is to be held prior to the cement being laid. The masts and spars are to be subject to examination by the Surveyors when deemed necessary by them on other occasions besides Special Surveys.

The requirements for the survey of engines and boilers are set forth at page 96.

RULES FOR THE BUILDING OF STEEL VESSELS.

Section 1. 1. When it is proposed to build ships of steel for classification in the Register Book, a sketch of midship section with longitudinal, deck, and other plans showing the details of the scantlings and arrangements, must in the first place be submitted through the local Surveyors for the approval of the Committee. Such vessels must be built under special survey to the plans approved and otherwise in accordance with the following Rules, subject to such modifications as may be deemed necessary by the Committee. All important plans should be submitted on tracing cloth.

Section 2. The measurements for regulating the Scantling Numbers are to be taken as follows (*See* **Sketch** on page 21) : —

LENGTH.

1. The **Length** (**L**) to be measured from the fore part of the stem to the after part of the stern-post on the range of the upper deck beams, except in awning or shelter deck vessels, in which cases the length is to be measured on the range of the deck beams next below the awning or shelter deck.

In vessels where the stem forms a cutwater the length (**L**) is to be measured from the place where the upper deck beam line would intersect the fore edge of stem if it were produced in the same direction as the part below the cutwater.

In the case of vessels having cruiser sterns the length (**L**) of the vessel is to be taken as 96 per cent. of the extreme length from the fore part of the stem on the range of the upper deck beams to the aftermost part of the cruiser stern, but it is not to be less than the length from the forepart of the stem to the after side of stern-post, where fitted, or to the fore side of the rudder stock, where a stern-post is not fitted. This length is to be used in determining the longitudinal and equipment numbers, and number of bulkheads.

In all cases plans of cruiser sterns, showing the scantlings and arrangements proposed, are to be submitted for the consideration of the Committee.

BREADTH.

2. The **Breadth** (**B**) is in all cases to be the greatest moulded breadth of the vessel.

DEPTH.

3. The **Depth** (**D**) is to be measured at the middle of length, from the top of keel to the top of beam at side of uppermost continuous deck, except in awning or shelter deck vessels, where it may be taken to the deck next below the awning or shelter deck, provided the height of 'tween decks does not exceed 8 feet. Where the height of 'tween decks exceeds 8 feet the (**D**) is to be measured from the top of keel to a point 8 feet below the awning or shelter deck.

In addition, a depth (d) is to be measured vertically at the middle of length, from top of ordinary floor at centre, or double bottom at side, to top of the beams of the lowest deck or tier of beams at side. By a "tier of beams" is meant a range of beams fitted either at every frame or at alternate frames ; or widely spaced beams not more than 24 feet apart in conjunction with a broad hold stringer. (*See* **Section 21** for size of hold stringer.)

SCANTLING NUMBERS.

4. The scantlings of the various parts of the vessel are to be determined by numbers obtained as follows :—

B + D is to be termed the **Transverse Number.**

L × (B + D) is to be termed the **Longitudinal Number.**

(B + D) regulates the frame spacing and scantlings of floors. (*See* **Tables 2, 3, 4,** and **5.**)

and

considered in association with (d) regulates the scantlings of frames, reversed frames and web frames. (*See* **Tables 2, 3,** and **5.**) For the framing and number of side stringers in way of a raised quarter deck the depth (d) is to be measured amidships and increased by the height of the raised quarter deck.

L × (B + D) regulates the scantlings of keel, stem, stern-post, side and bottom plating, double bottom, side stringers, keelsons, lower deck stringer plates, and lower deck plating. (*See* **Tables 1, 6, 7, 8,** and **17.**)

and

considered in association with the proportions of the vessel, regulates the thicknesses of side plating and deck plating, of upper, awning or shelter decks and of long erections. (*See* **Table 18.**)

(B) regulates the number of keelsons. (*See* **Section 14.**)

(d) regulates the number of side stringers. (*See* **Tables 2, 3,** and **5.**)

The length of amidship beams considered in association with the number of rows of pillars regulates the scantlings of beams. (*See* **Tables 11, 12,** and **13.**)

5. In vessels of exceptional fineness of form, intended for passenger traffic, or to carry a limited amount of cargo with a fixed freeboard, a modification in the scantlings may be admitted, subject to all particulars being submitted by the Builders, and approved by the Committee, and to the deviations from the Rules being sanctioned by the Owner.

PROPORTIONS.

6. The depth used in obtaining the proportions of length to depth is to be measured, at the middle of the length, from top of keel to top of beam at side of upper deck, or awning or shelter deck, except in way of a "Long" bridge where the depth is to be taken to the bridge deck. Beyond the ends of a "Long" bridge, and throughout when there is a "Short" bridge, the depth for proportions is to be taken to the upper deck.

7. The longitudinal strengthenings in relation to the proportions of vessels are to be as shown in **Table 18.**

8. For all vessels exceeding 14 depths in length, plans showing the proposals for affording the vessels sufficient strength longitudinally must be submitted for the approval of the Committee, and all vessels having a length exceeding $13\frac{1}{2}$ depths are to have a bridge extending over the midship half length of the vessel, or such special compensation for extreme proportions as may be required by the Committee.

9. In all cases where structural additions may be required for a certain portion of the length of a vessel, care should be taken to avoid any abrupt termination of the additional strength so obtained, by tapering the structural additions beyond these limits, and properly shifting their terminations.

Sketch Illustrating the Method of obtaining Scantling Numbers
(as per Section 2).

Dimensions 380′ 0″ × 51′ 0″ × 28′ 0″ Moulded Depth to Upper Deck.

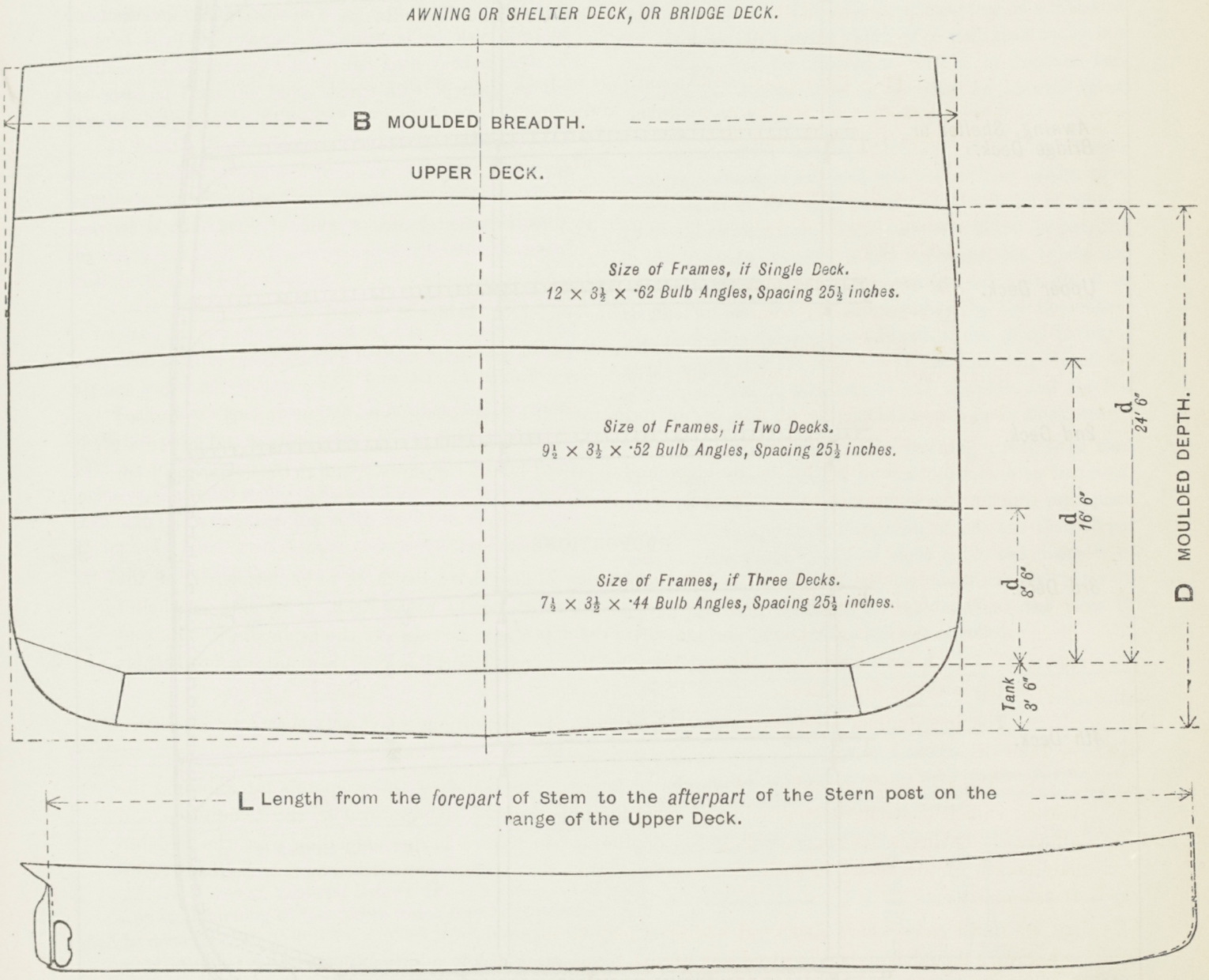
36′ 0″ „ „ „ Awning or Shelter Deck, or Bridge Deck.

Transverse No. (B + D) and d.

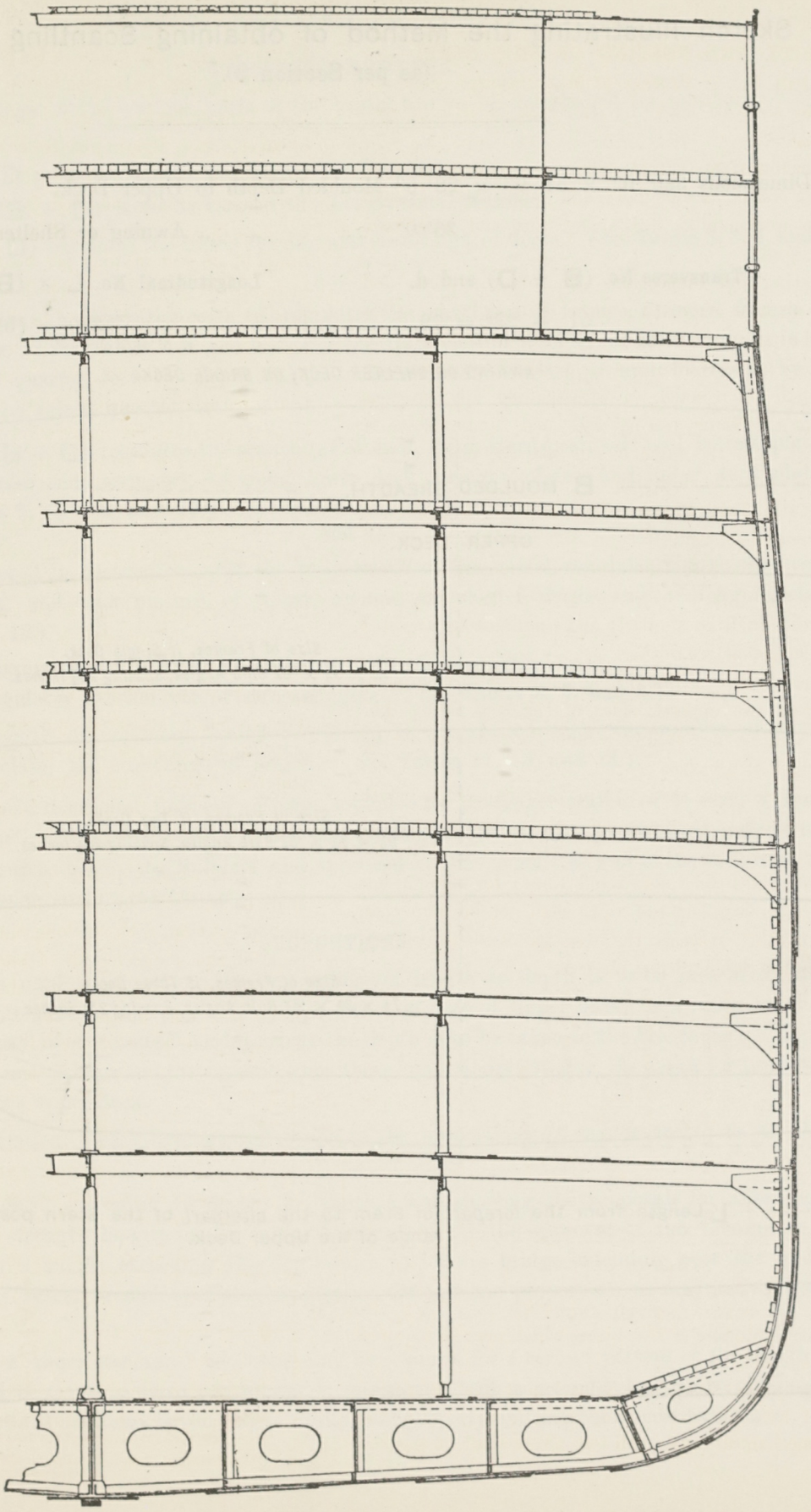
51′ + 28′ = 79.

Longitudinal No. L × (B + D).

380′ × (51′ + 28′) = 30,020.



Sketch of Midship Section giving designation of the various Decks.



QUALITY AND TESTING OF SHIP STEEL.

Section 3. 1. **Process of Manufacture.**—Steel for Shipbuilding shall be made by the Open Hearth process, Acid or Basic.

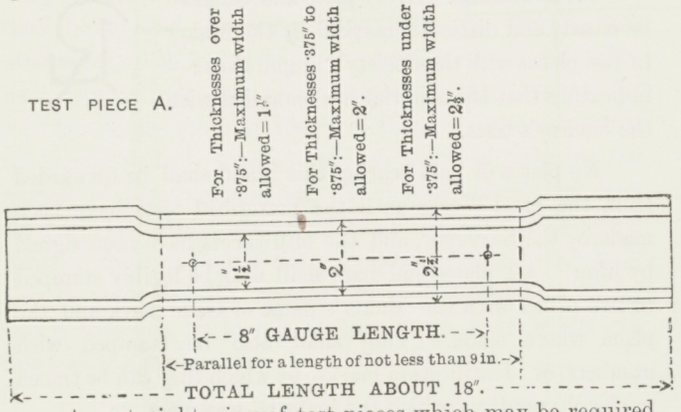
2. **Freedom from Defects.**—The finished material shall be free from cracks, surface flaws, and lamination. It shall also have a workmanlike finish, and must not have been hammer-dressed.

3. **Testing and Inspection.**—The following tests and inspections shall be made at the place of manufacture prior to despatch; but, in the event of any of the material proving unsatisfactory in the course of being worked into vessels, such material shall be rejected, notwithstanding any previous certificate of satisfactory testing, and such further tests of the material from the same charge may be made as the Surveyor may consider desirable.

4. **Tensile Test Pieces.**—The tensile strength and ductility shall be determined from Standard test pieces cut lengthwise or crosswise from the rolled material. When material is annealed or otherwise treated before despatch, the test pieces shall be similarly and simultaneously treated with the material before testing.

Plates:—Wherever practicable the rolled surfaces shall be retained on two opposite sides of the test piece. The elongation shall be measured on a Standard test piece having a gauge length of 8 inches.

For material more than ·875 in. in thickness the width of the test piece between the gauge points shall not exceed $1\frac{1}{2}$ ins.; for material ·875 in. to ·375 in. in thickness, inclusive, the width shall not exceed 2 ins.; for material less than ·375 in. in thickness the width shall not be more than $2\frac{1}{2}$ ins. In other respects the test pieces shall conform generally to the Standard test piece A.



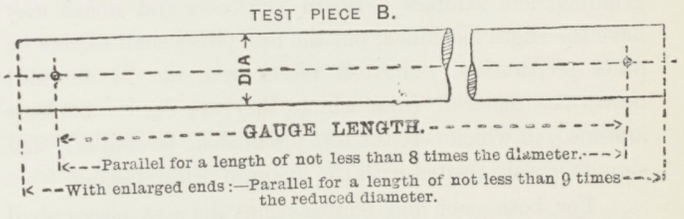
Any straightening of test pieces which may be required shall be done cold.

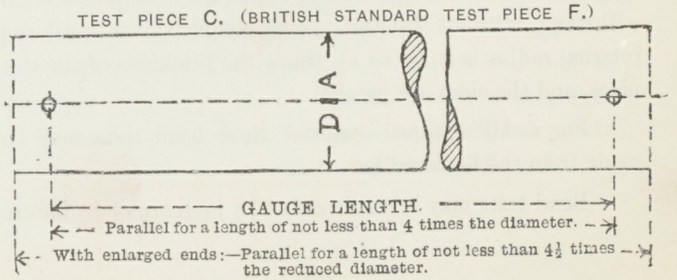
5. **Mechanical Tests and Selection of Test Pieces.**—Plates and bars for shipbuilding shall comply with the following mechanical tests. All test pieces shall be selected by the Surveyor and tested in his presence, and he shall satisfy himself that the conditions herein described are fulfilled.

6. **Tensile Tests.** Plates:—The tensile breaking strength of steel plates, determined from Standard test pieces, shall be between the limits of 28 and 32 tons per square inch. For plates specially intended for cold flanging and marked for identification, the tensile strength shall be between the limits of 26 and 30 tons per square inch. In the case of material for purposes in which tensile strength is not important, the tensile test may be dispensed with and the bend test only be made, if so specified by the builders and approved by the Committee. The elongation, measured on a Standard test piece having a gauge length of 8 ins., shall not be less than 20 per cent. for material of ·375 in. in thickness and upwards, and not less than 16 per cent. for material below ·375 in. in thickness.

Angles, Bulb Angles, Channels, etc.:—The tensile breaking strength of sectional material, such as angles, bulb angles, channels, etc., shall be between the limits of 28 and 33 tons per square inch. In the case of material for purposes in which tensile strength is not important, the tensile test may be dispensed with and the bend test only be made, if so specified by the builders and approved by the Committee. The elongation measured on a Standard test piece having a gauge length of 8 ins. shall not be less than 20 per cent. for material of ·375 in. in thickness and upwards, and not less than 16 per cent. for material below ·375 in. in thickness.

Rivet Bars:—The tensile breaking strength of steel rivet bars, when required by the Committee to be tested, shall be between the limits of 25 and 30 tons per square inch of section, with an elongation of not less than 25 per cent. of the gauge length of eight times the diameter of the test piece, measured on the Standard test piece B, or 30 per cent. measured on the Standard test piece C. The bars may be tested the full size as rolled.





When the Surveyor is in constant attendance at the Steel Works the following requirements are to be complied with :—

7. **Number of Tensile Tests.** Plates and Sectional Material :—One tensile test for plates or sectional material shall be taken from the finished material of each charge.

When the quantity of the material from one charge exceeds 25 tons, a second tensile test will be required; also additional tests shall be made for every variation in thickness of ·15 of an inch in the plates or sectional bars from each charge.

Rivet Bars :—When required by the Committee to be tested, one tensile test shall be taken from each charge used for rivet bars; but when the weight of the bars, as rolled, from one charge exceeds 10 tons, an additional tensile test shall be made for each further 10 tons or portion thereof.

Should a tensile test piece break outside the middle half of its gauge length, and the elongation be less than that required by the Rules, the test may, at the Maker's option, be discarded and another test be made of the same plate or bar.

8. **Bend Tests.**—Cold Bends :—Test pieces shall be sheared lengthwise or crosswise from plates or bars, and shall not be less than $1\frac{1}{2}$ ins. wide, but for small bars the whole section may be used. For rivet bars bend tests are not required.

Temper Bends :—The test pieces shall be similar to those used for cold bend tests. For temper bend tests the samples shall be heated to a blood red and quenched in water at a temperature not exceeding 80 degrees Fahr. The colour shall be judged indoors in the shade.

In all cold bend tests, and in temper bend tests on samples ·5 in. in thickness and above, the rough edge or arris caused by shearing may be removed by filing or grinding, and samples 1 in. in thickness and above may have the edges machined, but the test pieces shall receive no other preparation. The test pieces shall not be annealed unless the material from which they are cut is similarly annealed, in which case the test pieces shall be similarly and simultaneously treated with the material before testing.

For both cold and temper bends the test pieces shall withstand, without fracture, being doubled over until the internal radius is equal to $1\frac{1}{2}$ times the thickness of the test piece, and the sides are parallel.

For small sectional material these bend tests may be made from the flattened bar.

Bend tests may be made either by pressure or by blows.

9. **Number of Bend Tests.**—A cold or temper bend test shall be made from each plate or bar as rolled, and these tests shall be in about equal numbers from each charge; but a cold bend test shall be made from all plates which are specially marked for cold flanging.

10. **Tests for Manufactured Rivets.**—Rivets selected by the Surveyor from the bulk shall withstand the following tests :—

(*a*) The rivet shanks are to be bent cold, and hammered until the two parts of the shank touch in the manner shown in Fig. 1, without fracture on the outside of the bend.

(*b*) The rivet heads are to be flattened, while hot, in the manner shown in Fig. 2, without cracking at the edges. The heads are to be flattened until their diameter is $2\frac{1}{2}$ times the diameter of the shank.

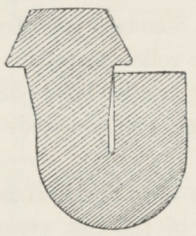


FIG. 1.

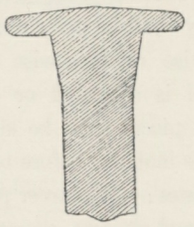


FIG. 2.

11. **Additional Tests before Rejection.**—Should any of the test pieces first selected by the Surveyor not fulfil the test requirements, two further tests may be made from the same plate or bar, but should either of these fail, the plate or bar from which the test pieces were cut shall be rejected. In all such cases further tests shall be made before any material from the same charge can be accepted.

12. **Branding.**—Every plate and bar shall be clearly and distinctly marked by the Maker in two places with the Society's brand, thus :— indicating that the material has complied with the Society's tests.

No plates or bars bearing this brand shall be forwarded from the Steel Works until the prescribed tests have been made by the Surveyor, and the mill sheets have been signed by him. All plates and bars shall also be legibly stamped in two places with the Maker's name or trade mark and the place where made. They shall also be stamped with numbers, or identification marks, by which they can be traced to the charge from which the material was made.

13. **Maker's Certificate.**—Before the mill sheets are signed by the Surveyor the Maker shall furnish him with a certificate guaranteeing that the material has been made by

the Open Hearth process, and that it has been subjected to, and withstood satisfactorily, the tests above described, in the presence of the Surveyor. The following form of certificate will be accepted if printed on each mill sheet with the name of the firm, and initialled by the Test House Manager :—

> "We hereby certify that the material described below has been made by the Open Hearth process, and is that which has been satisfactorily tested in the presence of the Surveyor in accordance with the Rules of Lloyd's Register."

14. **Rejected Material.**—In the event of the material failing, in any case, to withstand the prescribed tests, the Surveyor shall see that the Society's brand stamped on the plates and bars by the Maker has been defaced by punch marks extending beyond the brand in the form of a cross, thus :— denoting that the material has been rejected.

15. **Facilities for Inspection.**—The Maker shall adopt a system of marking the ingots, billets, slabs, plates, bars, etc., which will enable all finished material to be traced to the original charge, and the Surveyor must be given every facility for tracing all plates and bars to their respective charges, and for witnessing the required tests. When he is satisfied with the material and with the results of the tests, he shall be furnished with two copies of the advice notes of the material for his signature, one of which is to be forwarded by the Manufacturer to the Shipbuilder, and the other is to be forwarded by the Surveyor to the Surveyors at the port where the vessel is to be built.

16. **Steel not produced where Rolled.**—Where steel is not produced in the works at which it is rolled, a certificate shall be supplied to the Surveyor stating the Open Hearth process by which it was made, the name of the Steel Maker who supplied it, also the numbers of the charges, for reference to the books of the Steel Maker. The number of the charge shall be marked on each ingot or billet for the purpose of identification, and the finished plates and bars shall also be legibly stamped in two places with the maker's name or trade mark and the place where made. They shall also be stamped with numbers or identification marks by which they can be traced to the charge from which the material was made.

17. **Occasional Attendance at Steel Works.**—When the Society's Surveyor is not in constant attendance at the Steel works, the Makers themselves may, with the written authority of the Society, comply with all the foregoing requirements, and shall furnish the Surveyor with a certificate to the effect that the Society's Rules as to the testing of steel have been complied with in the case of the material submitted for approval. The Surveyor shall then make check tensile, cold, and temper bend tests from not less than one plate or bar in every batch of 50 or less number, provided the batch be all from one charge. If more than one charge is represented, each charge shall be tested. Additional tests shall also be made for every variation in thickness of ·15 of an inch made from one charge. The test pieces shall be selected by the Surveyor from the plates or bars, and not from shearings previously detached from them, and when marked by the Surveyor for testing they shall be followed, as far as practicable, through the different stages of preparation until the tests are completed.

Should the tests be unsatisfactory, the whole of the material from the charge shall be rejected, and the Surveyor shall see that the Society's brand is satisfactorily defaced.

18. **General.**—Besides the foregoing tests, samples of all material may be subjected to additional tests at the discretion of the Surveyors.

19. In cases wherein it may be desired by Owners and Builders, consideration will be given by the Committee to proposals for the use of steel of other tenacity than is provided for in the foregoing Rules.

QUALITY AND TESTING OF STEEL CASTINGS.

Section 4. 1. **Process of Manufacture.**—Steel for castings shall be made by the Open Hearth process, Acid or Basic, or by such other process as may be approved by the Committee.

2. **Annealing.**—All steel castings shall be thoroughly annealed in a properly constructed annealing furnace, which must permit of the whole casting being uniformly raised in temperature throughout its whole extent to the necessary intensity required for annealing purposes. The casting shall be allowed to cool down prior to removal from the annealing furnace; and if subsequently heated for any purpose it shall again be similarly annealed if required by the Surveyor.

3. **Testing and Inspection.**—The following tests and inspections shall be made, preferably at the place of manufacture prior to despatch, but in the event of any casting proving unsatisfactory in the course of preparation or fitting in the ship, such casting shall be rejected, notwithstanding any previous certificate of satisfactory testing.

4. **Tensile and Bend Test pieces.**—The tensile strength and ductility shall be determined from standard test pieces, which are to be prepared from sample pieces cast on the casting. These sample pieces are not to be cut, or partially cut from the castings until the annealing of such castings has been completed, nor until they have been stamped by the Surveyor. The test pieces are to be stamped by the Surveyor after the annealing. All test pieces shall be selected by the Surveyor and tested in his presence, and he shall satisfy himself that the conditions herein described are fulfilled.

5. **Number of Tests.**—At least one tensile test and one cold bend test are to be taken from each casting. In castings of complex design, referred to in paragraph 12, at least two tensile and two cold bend tests are to be taken. Where a casting is made from more than one charge of steel, at least four tensile and four cold bend tests are to be taken from pieces cast as far apart as possible on the casting, some test pieces being taken from as near the top and others from as near the bottom of the casting as practicable.

6. **Dimensions of Tensile Test pieces.**—The tensile test pieces are to be turned so as to have a diameter of ·564 inch with a gauge length of 2 inches, or a diameter of ·798 inch with a gauge length of 3 inches, or a diameter of ·977 inch with a gauge length of $3\frac{1}{2}$ inches.

7. **Dimensions of Bend Test pieces.**—The bend test pieces are to be machined to a rectangular section 1 inch wide by $\frac{3}{4}$ inch thick, with the edges rounded to a radius of $\frac{1}{16}$th of an inch. They are to be bent over the thinner section. The bending may be performed either by pressure or blows.

8. **Tensile Tests.** — The tensile breaking strength determined from test pieces of standard dimensions is to be between the limits of 26 and 35 tons per square inch, with an elongation of not less than 20 per cent. measured on the standard test piece.

9. **Bend Tests.**—The bend test pieces must withstand, without fracture, being bent cold through an angle of 120 degrees, the internal radius of the bend being not greater than one inch.

10. **Additional Tests before Rejection.**—Should either the tensile or bend test, or both, fail, and the Surveyor consider the fractured test piece or test pieces, or the results obtained therefrom, do not fairly represent the quality of the casting, a duplicate of the test or tests which failed shall be made if requested by the Maker. In such cases the quality of the casting shall be judged by the result of the duplicate test or tests and not by the original test or tests which failed.

11. **Percussive Tests.**—Stern frames cast in one piece to be let fall on hard ground (excavations being made to take bosses and other projections) after being raised through an angle of 45 degrees. Stern frames cast in more than one piece, rudders, steering quadrants, crossheads, tillers, etc., are to be dropped on hard ground from a height of from 7 to 10 feet according to the design, shape, and weight of the casting.

12. **Castings of Complex Design.**—Castings of complex design which would be liable to be deformed if submitted to the drop or percussive test, may have this test dispensed with provided two tensile and two cold bend tests be made upon pieces taken from positions as far apart as possible on each casting; one tensile and one bend test being taken from as near the top, and the others from as near the bottom of the casting as practicable.

13. **Hammering Tests.**—After being subjected to the percussive test, the casting in each case is to be subsequently slung up and well hammered with a sledge hammer not less in weight than 7 lbs., to satisfy the Surveyors that the casting is sound and without flaw. This hammering test is also to be applied to castings of complex design which may not have been submitted to a percussive test.

14. **Drilling Tests.**—In the case of large steel castings the Surveyors are to supplement the foregoing tests by drilling small holes at such parts of the castings as experience shows cavities and contraction cracks are most likely to occur, and at positions which are to be agreed upon between the Surveyor and the Manufacturer, in order to determine the soundness or otherwise of the casting. These holes are afterwards to be tapped and properly filled up with screw plugs.

15. **Branding.**—Every casting after it has satisfactorily withstood the prescribed tests, shall be clearly and distinctly marked by the Society's Surveyor indicating that the casting has complied with the Society's requirements.

QUALITY AND TESTING OF INGOT STEEL FORGINGS.

Section 5. 1. **Process of Manufacture.**—Ingot steel for forgings shall be made by the Open Hearth process,

Acid or Basic, or by such other process as may be approved by the Committee.

The forgings must be sound, they are to be made from sound ingots, and must be gradually and uniformly forged. The sectional area of the body of the forging (as forged) shall not exceed one-fifth of the sectional area of the original ingot, and no part of the forging (as forged) shall have more than two-thirds of the sectional area of the original ingot.

2. **Annealing.**—All important ingot steel forgings shall be thoroughly annealed in a properly constructed annealing furnace, which must permit of the whole forging being uniformly raised in temperature throughout its whole extent to the necessary intensity required for annealing purposes. If the forging be subsequently heated for any further forging it shall again be similarly annealed, if required by the Surveyor.

3. **Testing and Inspection.** — The following tests and inspections shall be made, preferably at the place of manufacture prior to despatch, but in the event of any forging proving unsatisfactory in the course of preparation, or fitting in the ship, such forging shall be rejected notwithstanding any previous certificate of satisfactory testing.

4. **Tensile and Bend Test Pieces.** — The tensile strength and ductility shall be determined from standard test pieces, which are to be prepared from sample pieces cut lengthwise from the forging, from a part of not less sectional dimensions than the body of the forging. Such standard test pieces shall be machined from the sample pieces without forging down, and the sample pieces shall not be detached from the forging until the annealing of such forging has been completed. The test pieces are to be stamped by the Surveyor after the annealing. All test pieces shall be selected by the Surveyor and tested in his presence, and he shall satisfy himself that the conditions herein described are fulfilled.

5. **Number of Tests.**—At least one tensile and one cold bend test are to be taken from each forging. Where a number of articles are cut from one forging, one tensile and one cold bend test from this whole forging will be sufficient.

6. **Dimensions of Tensile Test Pieces.**—The tensile test pieces are to be turned so as to have a diameter of ·564 inch with a gauge length of 2 inches, or a diameter of ·798 inch with a gauge length of 3 inches, or a diameter of ·977 inch with a gauge length of $3\frac{1}{2}$ inches.

7. **Dimensions of Bend Test Pieces.**—The bend test pieces are to be machined to a rectangular section 1 inch wide by $\frac{3}{4}$ inch thick, with the edges rounded to a radius of $\frac{1}{16}$th of an inch. They are to be bent over the thinner section. The bending may be performed either by pressure or by blows.

8. **Tensile Tests.** — The tensile breaking strength determined from test pieces of standard dimensions is to be between the limits of 28 and 32 tons per square inch, with an elongation on the standard test piece of not less than 29 per cent. for 28 ton steel, and 25 per cent. for 32 ton steel, and in no case must the sum of the tensile breaking strength and corresponding elongation be less than 57.

9. **Bend Tests.**—The bend test pieces must withstand, without fracture, being bent cold through an angle of 180 degrees, the internal radius of the bend being not greater than $\frac{1}{4}$ inch.

10. **Additional Tests before Rejection.**—Should either the tensile or bend test, or both, fail, and the Surveyor consider the fractured test piece or test pieces, or the results obtained therefrom, do not fairly represent the quality of the forging, a duplicate of the test or tests which failed shall be made if requested by the Maker. In such cases the quality of the forging shall be judged by the result of the duplicate test or tests and not by the original test or tests which failed.

11. **Branding.**—Every forging, after it has satisfactorily withstood the prescribed tests, shall be clearly and distinctly marked by the Society's Surveyor indicating that the forging has complied with the Society's requirements.

12. **General.**—The requirements as to annealing and testing are intended to apply to rudder heads and main pieces of rudder upon which arms are shrunk. They are not intended to apply to small forgings which during their last stage of manufacture are uniformly heated throughout.

(*For List of Steel Manufacturers, see pages* 129 *to* 144.)

STANDARD SECTIONS.

Section 6. The Sections of steel materials given in the following Rules are, with few exceptions, Standard Sections (*see* pages 145 to 149), and the thicknesses given in the Tables for the several Sections are the thicknesses of their webs

IRON WHERE USED INSTEAD OF STEEL.

Section 7. The rivets, keel, stem, stern-frame, rudder, pillars (as in Table 14) and lining pieces, also the floors, girders and top plating of double bottom in boiler space may be of iron of the sizes given by the Rules. Deck plating and ordinary floors, also the floors, girders, and top plating of double bottoms in holds, coal bunker, and other bulkheads, shaft tunnels, casings round engines, hatchway coamings, bulwarks and deck houses may be of iron 10 per cent. in excess of the thicknesses in steel where scantlings for the same are provided for in the Rules. No other parts of the vessel are to be of iron without the special sanction of the Committee. Iron where used is to be of good malleable quality, and subjected to tests in the shipyard when considered necessary by the Surveyor.

WORKMANSHIP.

Section 8. 1. The **Workmanship** to be well executed, and submitted to the closest inspection, and amended where necessary before coating or painting.

2. It is recommended that the black oxide or "mill-scale" be removed from the surfaces before coating or painting, which should be delayed as long as practicable.

3. Experience has shown that, as regards durability, it is highly desirable to place steel vessels in dry dock within a reasonably short time after being launched, for the purpose of cleaning and re-coating the bottom.

4. It is recommended that when plates are one inch and above in thickness the edges, as well as the butts, be planed before the rivet holes are punched.

KEEL, STEM, STERN AND PROPELLER POSTS.

Section 9. 1. The **keel, stem, stern,** and **propeller posts** are to be either scarphed or welded together, and to be in size according to **Table 1**; if scarphed, the length of scarphs to be nine times the thickness given in the Table; and the rivet-holes required in the *thin* ends of them are to be drilled after the scarphs are fitted.

Where stern-frames are in more than one piece, the length of the scarphs should not be less than three times the width of the stern-posts, and the breadth one and a half times the width of the stern-posts, secured by not less than four rows of rivets.

2. Where **Flat Plate Keels** are adopted, their breadth and thickness are to be as given in **Table 17,** and where such keels are used, intercostal keelson plates, or vertical centre-plates, must be fitted close down on the keel-plate, and connected to it by double angles of the dimensions given in **Table 6,** riveted all fore and aft to the keel-plate and keelson. For flat keel angles in double bottoms *see* **Table 8.**

3. The **stem** at its lower part is to be the same moulding as the keel, and attached to it by a scarph of the same length as the keel scarph; it may be gradually reduced from the height of the load-line to its head, where it may be three-fourths of the sectional area given in **Table 1.**

4. The lower portion of the stern-post forming part of the keel in sailing vessels, paddle steamers, and twin screw steamers having no aperture for propeller, is to extend sufficiently forward for the after end of its scarph to be at least once and a half the frame space forward of the stern-post, and the stern-post may be reduced from the lower part of the rudder trunk to its head where it may be three-fourths of the sectional area given in **Table 1.**

5. The lower portion of the stern-frame adjoining the keel in single screw vessels is to be tapered fairly into the keel, and to extend sufficiently forward for the after end of its scarph to be at least twice and a half the frame space forward of the propeller-post; the rudder-post may be reduced from the lower part of the rudder trunk to its head, where it may be of the size given for stems in **Table 1.**

6. **Connection to Transom-plate.**—The **stern-post** is to be extended sufficiently above the counter to be connected to the whole depth of the transom-plate by two vertical angles of the thickness of the transom-plate, which is to be fitted close against the stern-post. The transom-plate is to be of the thickness of the bottom plating at ends, and its depth not less than six times the thickness of "stern-frames with apertures." In screw steamers whose longitudinal number is above 16,000 the foremost or propeller post should extend sufficiently above the arch of the stern-frame to be efficiently connected to plating on the beams, and to a deep transom-plate.

7. In single screw steamers above 350 ft. in length the after lengths of shell plating are to be connected to the portion of the stern-frame below the boss with three rows of rivets.

8. **Rudder-braces** or **gudgeons** are to be forged on the stern-post, and spaced as given in **Table 24.** The upper gudgeon should be as near as practicable to the rudder trunk. The gudgeons are not to be less in depth than seven-tenths the diameter of the rudder head, and the thickness one-half the diameter of the pintles.

9. When **cast steel stern-frames** are fitted they are to be tested as described in **Section 4.** Sketches of the proposed castings are to be submitted for the approval of the Committee.

10. Ship forgings which require to be welded may be made of specially soft Open Hearth Ingot Steel instead of wrought iron, such steel to have a tensile breaking strength between the limits of 22 and 26 tons per square inch, with an elongation on the standard test piece (Sec. 5, par. 6) of not less than 35% for 22 ton steel and 31% for 26 ton steel; in no case must the sum of the tensile breaking strength and corresponding elongation be less than 57. The remaining tests and requirements are to be as prescribed by **Section 5** for ordinary ingot steel.

RUDDERS.

Section 10. 1. **For the diameters** of rudder heads *see* **Table 22.**

2. **For the scantlings** of rudders, coupling bolts, quadrants, tillers, and steering chains, *see* **Tables 23, 24** and **25.**

3. Forged rudder heads, frames, arms, pintles, gudgeons and crossheads, and tillers are to be of the best hammered iron or steel, but a mixture of iron and steel scrap must not be used for such forgings. For quality and testing of Ingot Steel Forgings, *see* **Section 5.**

4. When cast steel rudders, steering quadrants, crossheads, tillers, etc., are fitted they are to be tested as described in **Section 4.**

5. Ship forgings which require to be welded may be made of specially soft Open Hearth Ingot Steel instead of wrought iron, such steel to have a tensile breaking strength between the limits of 22 and 26 tons per square inch, with an elongation on the standard test piece (Sec. 5, par. 6) of not less than 35% for 22 ton steel and 31% for 26 ton steel; in no case must the sum of the tensile breaking strength and corresponding elongation be less than 57. The remaining tests and requirements are to be as prescribed by **Section 5** for ordinary ingot steel.

6. **Couplings.**—Where rudder heads are coupled the dimensions of the bolts and flanges or palms should not be less than required by **Table 23,** and the width of the material outside the bolt holes should not be less than two-thirds the diameter of the bolts. The nuts are to be in proportion to the size of the bolts, and locking plates, split pins, or other efficient means are to be adopted to prevent them from turning. A key or feather is to be fitted in horizontal and vertical couplings. The thickness of the tips of the palms of scarphed couplings is to be ·13 of the diameter of the head. (*See* **Sketches** on page 151.)

Where the form of the coupling is modified from that contemplated by the Tables the strength is to be equivalent to that required by the Rules.

7. **Pintles.**—The pintles are to be spaced as given in **Table 24,** and the top pintle should be as near as practicable to the rudder trunk. The pintles should be at least the full length of the gudgeons, and it is recommended they be made independent of the frame.

8. **Double Plate Rudders.**—The frame and main piece of **double plate rudders** must be efficiently forged and stayed at intervals corresponding with the pintles. The main piece is to have a straight taper from below the top pintle to the heel where it is to be of the size required by **Table 24.** The sectional area at the top pintle is to be not less than that of the rudder head.

9. **Single Plate Rudders.**—The main piece of **single plate rudders** is to have a straight taper from below the top pintle to the heel where it is to be of the size required by **Table 24.** The sectional area at the top pintle is to be not less than that of the rudder head. The arms to be fitted alternately on opposite sides of the plate. Fillets to arms forged or cast on the main piece are not to have a less radius than one-fifth the distance between the arms. Where arms are shrunk upon and keyed to the main piece, the latter is to be increased 10 per cent. in diameter in way of each arm to admit of an efficient key-way being cut. This increase in thickness is to be uniform all round the main piece, and is to extend above and below each arm for a distance equal to the increase in diameter, from which points it is to be gradually tapered over a similar distance into the normal diameter of the main piece. The thickness of the key is to be equal to 10 per cent. of the diameter of the main piece, and its breadth equal to twice its thickness.

10. **Rivets.**—The rivet holes in rudder plates and arms are to be countersunk and the rivets are to have full heads and points.

FRAMES AND REVERSED FRAMES.

Frames.

Section 11. 1. The **frames** to be of the dimensions set forth in **Tables 2, 3,** and **5,** and to extend from the keel to the gunwale. They are to fit closely to the upper edge of the keel; and the after frames should be sufficiently apart transversely to admit of sound riveting and workmanship. At the extreme ends of the vessel the lower parts of the frames opposite to each other are to be lapped and riveted together. In raised quarter-decks, bridges, poops, or forecastles, the frames are to extend to their deck stringers respectively.

2. **Heel Bars.**—When the frames are butted on the keel they are to have not less than 3 feet lengths of corresponding angle bars, fitted back to back, to cover and support the butts and be attached to the plating for at least three-fourths the vessel's length amidships. Similar pieces of angle bar are to be fitted if the frames are butted elsewhere.

3. The **rivet holes** to be punched from the faying surfaces of the frames, and they are not to be punched at the turn of the bilge until the frames are bent to the required shape; the holes in the way of the lands of the plating are to be drilled or "beared" after the frames are faired in place, and the plate edges lined off.

4. **Spacing.**—The spacing of the frames from centre to centre to range from 20 to 33 inches, according to the size of the vessel, and to be as required by **Tables 2, 3,** and **5.** The spacing amidships should not be exceeded around the stern of the vessel at the knuckle. In no case is the frame spacing to exceed 27 inches between the collision bulkhead and one-fifth the vessel's length from forward unless the frames are doubled to the height of the lowest tier of beams, and in the peaks the frame spacing is not to exceed 24 inches.

When a spacing of frames greater than that provided for in the Tables is adopted, the transverse framing, floors, inner bottom, beams, outside plating and deck plating, are to be proportionately increased.

5. When the **height between deck stringers** at the sides exceeds 8 feet at any part, additional transverse strength at such part must be submitted for approval. Where the frames are formed of frames and reversed frames, bulb angles, or channel bars without reversed frames, and the beams of the lowest tier are widely spaced, the height between the widely spaced beams and the deck above is not to exceed the depth for framing (d). Where, however, this height exceeds 9 feet, a side stringer, of the same scantlings as required to be fitted below is to be fitted midway between the widely spaced beams and the deck above, or other equivalent strengthening is to be introduced.

Reversed Angles on Frames.

6. **Reversed angles on floors and frames** to be in size as per **Tables 2, 3,** and **5.**

7. **Height of Reversed frames.**—Where one tier of beams, only, is fitted and the depth (d) is above 7 feet and does not exceed 9 feet, the reversed frames are all to extend to the upper turn of bilge.

When the depth (d) is above 9 feet and does not exceed 11 feet, the reversed frames are to extend to upper turn of bilge and side stringer alternately.

When the depth (d) is above 11 feet and does not exceed 13 feet, they are to extend to side stringer and upper deck stringer plate alternately.

When the depth (d) is above 13 feet and does not exceed 27 feet, all the reversed frames are to extend to the upper deck stringer plate.

8. Where more than one tier of beams are fitted in steamers, and the height of 'tween decks does not exceed 8 feet the reversed frames are to extend to the upper deck stringer plate and deck stringer plate next below alternately.

Where the height of 'tween decks exceeds 8 feet, or where an awning or shelter deck or long bridge is fitted, the framing in the 'tween decks or the height to which the reversed frames should extend will be specially considered.

9. When the framing consists of channel bars with reversed frames, the latter are to extend to the lower edge of the beams at the lowest deck.

10. Where the beams in the lowest tier are widely spaced, the reversed frames are to extend at least to the deck above on all frames.

11. **Overlap of Frames upon Reversed frames.**—Where the frames and reversed frames are connected with $\frac{5}{8}$ inch rivets the overlap of frame upon reversed frame is to be not less than $2\frac{1}{4}$ inches. Where $\frac{3}{4}$ inch rivets are used the overlap is to be not less than 3 inches, and where $\frac{7}{8}$ inch rivets are used the overlap is to be not less than $3\frac{1}{2}$ inches.

12. **Double reversed angles** are to be fitted on every floor, extending from bilge to bilge in the engine and boiler spaces of steam vessels; and where the longitudinal number is above 11,000, they are to extend sufficiently high to

admit of the stringer at upper part of bilge being connected to them.

Short double reversed angles are to be fitted on all floors in the way of the keelsons, connected by not less than three rivets to the floor.

13. **Additional Reversed Frames and Stringers.**—In vessels where the longitudinal number is above 15,000, reversed angles should be fitted to every frame to the height of the upper deck, abaft the after peak bulkhead. Where such vessels have broad flat counters, a double angle stringer should be fitted to the framing in the 'tween decks for a reasonable length, connected by plate knees to the transom plate; or other additional strengthening applied, as the Surveyors may deem necessary.

14. **In top-gallant forecastle** of vessels whose longitudinal number is above 14,000, the alternate reversed frames are to extend to the forecastle deck, or other efficient means of strengthening the forecastle may be adopted, if approved by the Committee.

FLOOR-PLATES.

Section 12. 1. The **floor-plates** to be in size at the middle line according to **Table 4**, excepting in the engine space in steam vessels, where they must be ·04 of an inch thicker, and in the boiler space ·10 of an inch thicker.

2. The floor-plates are to be **moulded** not less than one-half their midship depth at a distance of three-quarters the half breadth of the vessel set out from the middle line on the run of the frame, and not less at their extreme ends than the moulding of the frames; and they are to extend in a fair curve well up the bilges, in no case terminating lower at the outside of the frame than a perpendicular height above the top of keel of twice the midship depth of the floor as fitted. In vessels of unusually fine or full form the moulding is to be modified to the approval of the Committee.

The ends of the floors to maintain the height prescribed for one quarter of the vessel's length amidships. They may then be gradually lowered forward and aft until the upper edges of the floor-plates are level (this place to be determined by the form of the vessel), from which to the ends they are to be gradually increased in depth, so as to efficiently connect the sides.

3. A floor-plate to be fitted and riveted to every frame, and to be extended across the middle line, except where a vertical centre-plate is adopted, in which case the floor-plates are to be efficiently connected to it on each side by double vertical angles of the thickness of the centre plate and with flanges not less than $2\frac{1}{2}$ inches for $\frac{5}{8}$ inch rivets, 3 inches for $\frac{3}{4}$ inch rivets, and $3\frac{1}{2}$ inches for $\frac{7}{8}$ inch rivets.

4. **When in two lengths.**—When floors are made in two lengths, the butts are to be riveted in accordance with the requirements of **Table 21.**

5. Floor-plates to which the bulkheads are attached must be deeper than the adjacent floor-plates, to admit of the bulkheads being riveted to them above the reversed angle bars.

6. In the **after peak of steam vessels** the floors are to extend well above the stern tube, and in vessels of full form where the extension of the floor-plate may not be practicable, broad cross tie-plates are to be fitted above the stern tube, stiffened with angles or flanged on both upper and lower edges. Stringer plates are also to be fitted at this part connected to the outside plating. The floors and cross-tie-plates in the after peak are to be connected to the frame angles with rivets spaced not more than five diameters apart.

7. **Watercourses** are to be formed above the frames through all the floor-plates on each side of the middle line, also at the lower turn of the bilges in vessels of full form, as well as through the vertical centre-plate, and intercostal keelsons, when such keelsons are adopted, so as to allow water to reach the pumps freely.

8. **Transom-plates** are to be fitted and connected to the frames, and to the stern-post, so as to efficiently support the counter. (*See* **Section 9, paragraph 6.**)

WEB FRAMES.

Section 13. 1. **Web Frames,** six frame spaces apart, in conjunction with **side stringers** in hold and intermediate transverse frames, may be fitted, if arranged in accordance with **Table 5** and with the conditions specified below (*See* **Sketches** on pages 153 to 155) :—

The depth (**d**) for regulating the scantlings of web frames, and the number of the side stringers required to be fitted, is to be taken from the top of the floors to the top of the beams of the lowest laid deck at side.

2. Face angles of the size given in **Table 5** are to be riveted on the inner edge of the web frames and side stringers.

3. The double angles connecting the stringers to the web frames and the angles connecting the stringers and web

frames to the outside plating are to be of the thickness of the web frames and with flanges—

4 inches × 4 inches for 1-inch rivets.
$3\frac{1}{2}$ „ × $3\frac{1}{2}$ „ $\frac{7}{8}$ „
3 „ × 3 „ $\frac{3}{4}$ „

Where the depth of web frame is above 24 inches, the web frames are to be attached to the outside plating by double angles or by equivalent single angles double riveted. Where the transverse number is above 111, the stringer plates are to be attached to the outside plating with double angles for a length of three frame spaces on each side of the bulkheads.

4. **Butt straps** of the form shown by **Sketches** on pages 153 to 155, are to be fitted at the junction of web frames and side stringers, and are to be of the scantlings given in **Table 5.**

5. The **deck beams** are to be attached to the web frames at their head by bracket knees of the thickness of the web frames flanged on their inner edge. The breadth and depth of these knees are to be equal to the depth of the web frame, and they are to be measured from the lower edge of the beam and the inner edge of the web frame. The knees are to be double riveted in each arm.

6. The side stringers are to be supported by a **bracket knee plate** of the same thickness as the stringers fitted midway between the web frames when the depth of web frame is above 16 inches and does not exceed 18 inches, and where this depth is above 18 inches, the brackets are to be fitted to alternate frames.

7. The length of frame extending above a web frame is to be of the same strength as the intermediate frames.

8. In **single deck vessels** framed with web frames all the reversed frames are to extend to the upper deck stringer plate.

9. Where more than one tier of beams are fitted in steamers having web frames and the height of 'tween decks does not exceed 8 feet the reversed frames are to extend to the upper deck stringer plate and beam stringer plate below, alternately. Where the height of 'tween decks in such vessels exceeds 8 feet or where a long bridge, awning or shelter deck is fitted, the height to which the reversed frames should extend or the framing in the 'tween decks will be specially considered.

10. The distance between stringers or between the lowest stringer and top of floors at centre in way of single bottoms, and top of margin plate in way of double bottoms, is not to exceed 8 feet at any part of the vessel.

KEELSONS.

Section 14. 1. The **scantlings** and **arrangements** of keelsons are to be as required by **Table 6** and shown by **Sketches** on pages 156 to 158.

2. When keelsons are formed of **vertical plate and four angles** the broader flanges of the upper angles are to be fitted horizontally, and there is to be a rider plate on the top of the same thickness as the vertical plate, and one inch broader than the sum of the horizontal flanges of the angles.

3. The bottom angles of **keelsons** are to be **attached to the reversed frames** and to short double reversed frames fitted in way of the keelsons connected by not less than three rivets to the floors. When these double reversed frames form butt straps for the ordinary reversed frames there should be at least three rivets on each side of the butt.

4. **Continuity.**—It is recommended that keelsons be carried fore and aft continuously through the bulkheads, the latter being made watertight around them, and, when such parts of the ship are necessarily separated the longitudinal strength is to be efficiently maintained to the satisfaction of the Surveyors. When keelsons, or other longitudinal strengthening, are required for a certain portion of the length of a vessel, care should be taken to overlap or properly shift the ends of the same so as to avoid any abrupt termination of strength.

5. **Butt Connections.**—All angle and bulb angle bars of keelsons are to be in long lengths, properly shifted, and wherever butted, to be connected with angles not less than 2 feet long, fitted in the throat of them, properly riveted to each flange. The thickness of the connecting straps is not to be less than the thickness of the angle bars they connect. The butts of the plates of keelsons are to be properly shifted and riveted as required by **Table 21.** The butts of the vertical plates are to be secured with double butt straps, each not less than ·14 of an inch thicker than half the thickness of the plates they connect, or the butts may be overlapped.

6. **All Middle Line Keelsons** are to extend as far forward and aft as practicable; the rider plates need not, however, extend beyond $\frac{3}{4}$ the vessel's length amidships.

7. **Middle Line Keelsons standing upon floors** may be formed of double-bulb angles when the longitudinal

number does not exceed 4,700, when the longitudinal number is above 4,700 and does not exceed 26,000 the keelson is to be formed of a vertical plate, four angles and rider plate, and when the longitudinal number is above 26,000, a foundation plate 18 inches by ·50 of an inch is to be fitted on the top of the floors.

8. When **Flat Plate Keels** are adopted, intercostal or centre through plate keelsons must be fitted.

9. **Middle Line Keelsons with Intercostal Plates.**—The intercostal plates are to be attached to the floors by double angles of the thickness of the intercostal plates, and with flanges not less than $2\frac{1}{2}$ inches for $\frac{5}{8}$-inch rivets, 3 inches for $\frac{3}{4}$-inch rivets, and $3\frac{1}{2}$ inches for $\frac{7}{8}$-inch rivets.

10. **Centre Through Plate Keelsons.**—The centre through plate is to be of the thickness given in **Table 6**, and a foundation plate not less than 24 inches in width and of the same thickness as the centre through plate is to be fitted on the top of the floors, and attached to the centre girder by continuous angles, or the centre through plate may be extended above the top of the floors, and a foundation plate fitted on each side not less than 12 inches in width. Where the longitudinal number is above 10,000 and not exceeding 17,200, double bulb angles of the size given in **Table 6** are to be fitted above the foundation plates and attached to the centre through plate, and where the longitudinal number is above 17,200, the centre through plate is to extend above the floors to the height given on **Table 6**, and in addition to the foundation plates, four angles of keelson size are to be fitted with a rider plate of the same thickness as the centre through plate.

11. **Side Keelsons** are to be fitted with intercostal plates attached to the outside plating by angles of the thickness of the intercostal plates, and with flanges not less than $2\frac{1}{2}$ inches for $\frac{5}{8}$-inch rivets, 3 inches for $\frac{3}{4}$-inch rivets, and $3\frac{1}{2}$ inches for $\frac{7}{8}$-inch rivets.

12. When the breadth of the vessel does not exceed 27 feet, **one side keelson** is to be fitted on each side extending as far forward and aft as practicable.

13. Where the breadth is above 27 feet and not exceeding 50 feet **two side keelsons** are to be fitted on each side extending as far forward and aft as practicable. If these keelsons are formed of plate, four angles and rider plate, the depth of the vertical plate of the keelson nearest the middle line may be gradually reduced beyond three-fourths the vessel's length amidships to the breadth of the flanges of the lower angles, and the rider plate need not extend beyond the three-fourths length. The depth of the vertical plate of the outer **side keelson** may be similarly reduced beyond three-fifths the vessel's length amidships.

14. When the breadth is above 50 feet and does not exceed 54 feet **two side keelsons** are to be fitted as required in the previous paragraph, and in addition **a bilge keelson** formed of double angles and intercostal plates is to be fitted on each side extending as far forward and aft as practicable.

SIDE STRINGERS.

Section 15. 1. The number of **side stringers** is to be as required by **Tables 2 and 3**, and their scantlings and construction as given in **Table 7**, and shown by the **Sketches** on page 152. For side stringers in conjunction with web frames *see* **Section 13** and **Table 5**.

2. The **spacing of side stringers** at ends of vessels is not to exceed that amidships.

3. The **side stringers** are to be formed of continuous angles fitted on the inside of the frames, or of the reversed frames, and when the depth of framing exceeds 3 inches by **Table 2** and 4 inches by **Table 3**, intercostal plates are to be fitted, attached to the outside plating by angles of the thickness of the intercostal plates, and with flanges not less than $2\frac{1}{2}$ inches for $\frac{5}{8}$-inch rivets, 3 inches for $\frac{3}{4}$-inch rivets, $3\frac{1}{2}$ inches for $\frac{7}{8}$-inch rivets, and 4 inches for 1-inch rivets. The stringer angles are to be attached to each reversed frame, or to angle lugs on the frames with at least two rivets, and connected by brackets to the transverse watertight bulkheads, as shown by the **Sketch** on page 166.

4. **Butt Connections.**—The butts of side stringers are to be properly shifted and the angle bars are to be efficiently strapped at the butts with angles not less than 2 feet in length. The thickness of the angle straps is not to be less than the thickness of the angle bars they connect. The intercostal plates are to be in long lengths and strapped at the butts. (*See* **Sketch** on page 166.)

5. If it should be desired to omit one or more of the side stringers required by this section of the Rules a sketch is to be submitted showing the compensation proposed for such omission.

DOUBLE BOTTOMS AND WATER BALLAST TANKS.

Section 16. 1. **Scantlings and attachments.**—The scantlings and attachments of the various parts forming the double bottom are to be as required by **Tables 8 and 9.**

2. **Side keelsons and part double bottoms.**—Where part double bottoms are fitted the side keelsons are to extend into, or scarph the double bottom, not less than three spaces of frames, and be connected to the longitudinal girders where practicable. Where double bottoms are fitted in the fore and after holds and not extended through the engine and boiler space, care is to be taken to provide against an abrupt termination in the longitudinal strength. The girders are either to be carried through the engine and boiler space, or connected with longitudinal engine and boiler bearers, or otherwise arranged to the satisfaction of the Surveyor.

3. **A "Well" to be formed in the engine-room.**—Where a double bottom extends through the engine and boiler space, a "well" should be formed between the engine-room after bulkhead and the floor immediately before the same, for the drainage of water; or open gutter ways of sufficient size should be made in the wings, so as to be always accessible.

4. **Side girders.**—Side girders in a double bottom are to be extended as far forward and aft as accessibility to all parts will admit. The girder nearest the middle line is to be extended to the collision bulkhead, except where fineness of the form of a vessel renders this unnecessary for the efficient stiffening of the bottom plating.

Where the side girders are spaced more than 6 feet apart the **watertight floors** in double bottom are to be stiffened by vertical angles, of the size of the frame angle on floor, fitted midway between the girders.

5. **Double reversed frames in machinery space.**—Double reversed angles are to be fitted on every floor in engine space, and on each floor in way of boiler bearers. They are to extend in all cases from the middle line to beyond the girder next outside the engine seating.

6. **Free passage of air between divisions.**—It is of importance that ample provision should be made for the free passage of air from one division to another, so that it may readily find its way to the air pipes. This should be done by fitting the liners short, setting down the angle bar from the inner bottom wherever necessary, and leaving, otherwise, a sufficient number of holes as near to the inner bottom as practicable.

The **air pipes** should also be sufficient in number and size; and, wherever necessary, one should be fitted at each end of each tank on both sides of the vessel.

7. **Tank side brackets and angles.**—Bracket plates are to be fitted outside the double bottom, riveted to the margin plate and to every frame all fore and aft, and to extend up the bilges to the height given in **Table 8.** The bracket plates are to maintain this height throughout the half length of vessel amidships and thence to fore end of double bottom; but abaft the half length amidships the height may be gradually reduced to the level of the inner bottom at the after end of double bottom.

The breadth of the bracket plate at the ship's side and its rivet attachment to the frame angle must, however, in no case be less than its breadth and attachment at the margin plate. The angle bars connecting outside bracket knees to the margin plate are to be fitted on the same side of the bracket plates as the corresponding angles connecting the floor ends or inside brackets to the margin plate.

8. **Margin plates.**—The margin plate is to be of the depth and thickness required by **Tables 8** and **9**, and is to be efficiently connected to the outside plating and frames of the main body of the vessel. The full depth of the margin plate is to be maintained throughout the midship three-fifths length of the vessel and to the fore part of double bottom, but abaft the midship three-fifths length of the vessel the depth may be gradually reduced to a depth at the after end of 15 per cent. less than the midship depth.

When gusset plates or other ties are fitted connecting the outside bracket knees to the inner bottom, the horizontal flanges of the margin plates are to be of sufficient width to admit of the gusset plates being efficiently fitted and riveted clear of the landing edge of the inner bottom, and the upper surface of the reversed frames on top of the outside bracket knees should be fair with the top of the inner bottom.

9. **Manholes and covers.**—Manholes, with wrought iron or steel covers, must be constructed so as to enable the inner surfaces of outside and inner bottom plating, the frames, floors, girders, and rivets to be thoroughly examined and coated when required, and where the manhole covers are attached by bolts to the inner bottom plating, doubling plates or rims are to be fitted to receive the fastenings of the covers.

Where the manhole covers in the double bottoms of cargo holds, or their fittings, project above the tank top, and the ceiling is omitted, they must be protected by fitting an angle coaming around each manhole with a hatch either of wood or of steel fitted therein.

Manholes are not to be cut in the centre girder within three-fourths the vessel's length amidships. The manholes in the floor plates, side girders, and inner bottom plating are to be no larger and not more numerous than necessary to render all parts of the double bottom readily

accessible. The edges of the manholes should be smooth to enable them to be entered with facility.

10. **Workmanship and Testing.**—All watertight joints are to have the surfaces of steel fitted close to each other and caulked, without, as far as practicable, the use of felt, canvas, &c. The double bottom is to be caulked and made watertight, and each compartment intended for water ballast is to be tested on completion with a head of water to the height of the load water line.

11. **Alternative arrangements.**—Any other plan of fitting double bottoms than those hereafter referred to may be adopted, provided in the first instance it receives the approval of the Committee.

Cellular Double Bottoms with a Floor Plate fitted at Every Frame.

12. **Construction.**—Where double bottoms are constructed with floor plates, lightened with manholes, fitted to every frame, and continuous in one length from the middle line to the margin plate, intercostal side girders are to be fitted between the centre girder and margin plate, in accordance with the requirements of **Table 8**, well connected to the floors and to the inner and outer bottom plating.

13. **Additional girders in way of engines.**—Additional intercostal girders are to be fitted in way of the engine seating.

14. **Inner bottom plating.**—The inner bottom plating is to be continuous and wrought longitudinally. The butts to be shifted well clear of each other and the edges to be shifted well clear of the girders.

15. **Outside plating.**—The outside plating (except flat keel plates and garboard strakes) which is entirely within the boundary of a double bottom having floors fitted at every frame, and which does not exceed ·66 of an inch in thickness amidships, may be reduced ·02 of an inch where the plating is ·52 of an inch in thickness, ·04 of an inch where the plating is ·54 and not more than ·64 of an inch in thickness, and ·02 of an inch where the plating is ·66 of an inch in thickness, but where the plating exceeds ·66 of an inch in thickness amidships no reduction will be permitted in the outside plating.

Cellular Double Bottoms with Floor Plates fitted at Alternate Frames.

16. **Construction.**—Where double bottoms are constructed with floor plates lightened with manholes, fitted to alternate frames, side girders are to be fitted in accordance with the requirements of **Table 8**, well connected to the floors and to the inner and outer bottom plating.

In all cases floor plates are to be fitted under the boiler bearers, also to every frame in the engine space and from the three-fifths length amidships to the collision bulkhead.

Where the rule length of vessel exceeds 400 feet, and in single-deck vessels which exceed 26 feet moulded depth, the double bottom is to be constructed throughout with a floor plate at every frame and with longitudinal girders as required for that system of construction.

17. **Intermediate frames and reversed frames.**—Intermediate frames and reversed frames of the size given in **Table 8** are to be fitted for stiffening the outside plating and tank top, unless the longitudinal girders are more closely spaced than required by the Table, or the inner bottom plating be increased ·04 of an inch in thickness, when the intermediate reversed angles may be dispensed with.

18. **Bracket plates on intermediate frames.**—Bracket plates are to be fitted to the centre girder and margin plates at the intermediate frames inside the double bottom, and where the longitudinal number is above 20,000, the brackets are to be of sufficient breadth at the top to take three rivets in the vertical flange of the intermediate reversed angles, for $\frac{3}{5}$ths the vessel's length amidships.

19. **Stiffeners to Side Girders.**—Vertical angles are to be riveted to the side girders and attached at their ends, by not less than two rivets, to the intermediate frames and reversed frames.

20. **Inner bottom plating.**—The inner bottom plating is to be continuous and wrought longitudinally. The butts to be shifted well clear of each other and of the butts of the longitudinal girders, and the edges to be shifted well clear of the latter.

Double Bottoms Formed with Girders on top of Ordinary Floors.

21. **Construction.**—Where double bottoms are fitted with longitudinal girders extending on top of ordinary floors the girders must be spaced not more than 3 feet apart with a continuous angle on the upper and lower edges, and in addition to be connected by vertical angles on the floors and girders. Side intercostal plates need not be fitted in the range of double bottom except where the breadth of the vessel exceeds 46 feet.

22. **Accessibility.**—The height of the tank top above the floors to be at least sufficient for easy access and examination of the inside of tank.

23. **Floor end brackets.**—Bracket plates are to be fitted inside and outside the double bottom attaching the margin plate to every floor plate and frame.

ADDITIONAL STRENGTHENING OF THE FORE PART OF THE BOTTOM OF STEAMERS.

Section 17. 1. **Riveting.**—The rivets in the plating and frames, in the bottom of steamers, forward of the three-fifths length, are to be spaced not more than $5\frac{1}{2}$ diameters apart from centre to centre.

2. **Side girders.**—Where a double bottom is constructed with a **floor at every frame** additional intercostal girders of one-half the depth of the centre girder are to be fitted forward of the three-fifths length of the vessel, extending as far forward as practicable.

Where the double bottom is constructed with **floors at alternate frames amidships** and with the floor plates fitted to every frame forward of the three-fifths length, additional girders need not be fitted provided that the ordinary side girders extend as far forward as practicable, and provided that the total number of intercostal girders forward of the three-fifths length be not less than would be required by the preceding paragraph.

Where there is no double bottom in the fore part of a steamer, additional intercostal side keelsons are to be fitted from the three-fifths length to the Rule position of the collision bulkhead.

3. **Double frames.**—The **frames** are to be doubled from the three-fifths length forward to the Rule position of the collision bulkhead, from margin plate to margin plate of double bottoms, or to the turn of bilges where double bottoms are not fitted.

4. **Outside plating.**—The three strakes of outside plating next the keel are to have the midship thickness maintained forward to the Rule position of the collision bulkhead.

5. **In vessels with engines fitted aft,** whose longitudinal number does not exceed 10,000, the above additional strengthening is to be fitted from the midship half-length of the vessel and extended to the Rule position of the collision bulkhead; and in place of the double frames referred to in paragraph 3, intermediate frames of the size required for peak frames by Table 3 may be fitted midway between the floors and extended to the margin plate of double bottom, or to the turn of the bilges, as required by that paragraph.

6. Floor plates or intercostals are not to be flanged in the range of the additional strengthening required by this Section.

COASTING VESSELS INTENDED TO LOAD OR DISCHARGE WHILE LYING ON THE GROUND.

Section 18. In the case of small coasting vessels intended to load or discharge while lying aground, it is recommended that the bottoms be additionally strengthened in order to withstand the exceptional stresses to which they may be subjected.

WATERTIGHT BULKHEADS.

The compulsory application of the Society's amended Rules and Tables relating to Watertight Bulkheads was suspended on 26th October, 1916, and scantlings and arrangements of bulkheads will be approved provided they are not of less efficiency than required by the Society's Rules and Tables prior to the amendments adopted in May, 1915, and the scantlings are determined by the height to which the bulkheads are carried, and provided the Society's amended Rules for shaft tunnels be adhered to so far as it is reasonably practicable to do so.

Section 19. 1. **Peak and Machinery Space Bulkheads.**—A watertight collision bulkhead is to be fitted at not less than 5 per cent. of the vessel's length from the fore part of the stem at the load waterline.

An after peak bulkhead and bulkheads dividing the machinery space from the cargo and the passenger spaces are also to be fitted. In all cases stern tubes should be enclosed in watertight spaces.

2. **Additional Bulkheads.**—Additional watertight bulkheads are to be fitted as follows:—

In vessels above 285 feet and not exceeding 335 feet in length, an additional watertight bulkhead is to be fitted in the main hold about midway between the collision and boiler room bulkheads.

In vessels above 335 feet and not exceeding 405 feet two additional watertight bulkheads are to be fitted, one in the forward hold and one in the after hold.

In vessels above 405 feet and not exceeding 470 feet three additional watertight bulkheads are to be fitted.

In vessels above 470 feet and not exceeding 540 feet four additional watertight bulkheads are to be fitted.

In vessels above 540 feet and not exceeding 610 feet five additional watertight bulkheads are to be fitted.

In vessels above 610 feet and not exceeding 680 feet six additional watertight bulkheads are to be fitted.

Where the machinery is fitted aft in vessels above 220 feet and not exceeding 285 feet long, a watertight bulkhead is to be fitted about midway between the collision bulkhead and the bulkhead at the fore end of the engine and boiler space.

In vessels having cruiser sterns, the length for determining the number of watertight bulkheads is to be measured as required by **Section 2** for vessels of this type.

The bulkheads of Sailing vessels are considered in **Section 47.**

3. **Height of Bulkheads.**—The collision bulkhead is to extend to the Upper, Awning, or Shelter deck.

All other bulkheads are to extend to the upper deck, except the after peak bulkhead, which subject to the approval of the Committee may extend to the first deck above the load water line, provided this deck forms a watertight flat from the bulkhead to the stern.

In all vessels the machinery openings are to be trunked in to the height of the **Awning, Shelter or Weather deck.**

In awning or shelter deck vessels, or vessels with a continuous superstructure or bridge house, a deep web frame or partial bulkhead is to be fitted on each side in the 'tween decks, over each of the watertight bulkheads which extend only to the deck next below the awning or shelter deck. Partial bulkheads may be dispensed with if other efficient strengthening is provided to the satisfaction of the Committee.

4. **Bulkhead Plating.**—The plating is to be of not less thickness than required by **Table 10 C.** The lowest strake is to be at least 36 inches in height measured from the tank top, or from the keel in vessels having no double bottom, but where there is a double bottom one side of the bulkhead only, the lowest strake should extend at least 12 inches above the double bottom. In all cases the lowest strake is to be at least ·04 inch thicker than required by the Table, and in the case of a stokehold or bunker bulkhead this strake is to be ·10 inch thicker than required by the Table. Where the bulkhead is at the end of a stokehold space the bottom plating of the bulkhead is to extend to a height of not less than 24 inches above the stokehold floor. Plates in the limber are to be ·10 inch thicker than required by the Table.

5. **Bulkhead stiffeners.**—Vertical stiffeners are to be fitted of the size required by **Tables 10** and **10 A**, spaced 30 inches apart (*see* **Sketches** on pages 162 to 165), but this spacing may be increased up to a maximum amount of 36 inches provided the stiffeners be correspondingly increased in strength and stiffness.

The lower end of each stiffener is to be attached to the shell plating, to the inner bottom plating or to efficient horizontal plating. At each deck level which forms the top of a system of stiffeners, plating is to be provided of a character which will ensure horizontal rigidity in the bulkhead. In the case of hold stiffeners connected to the inner bottom plating the lower bracket or its connecting angle is to extend over the floor adjacent to the bulkhead, and this should be a solid floor; the upper bracket is to be connected to angles which extend over the beam space or to the beam adjacent to the bulkhead, or other effective means are to be adopted for securing the necessary structural rigidity at these parts. Where stiffeners are cut in way of watertight doors in the lower part of a bulkhead the opening is to be suitably framed, and a tapered web plate or buttress, stiffened on its edge, is to be fitted at each side of the door from the base of the bulkhead to well above the door opening. Where stiffeners are not cut, but where the space between stiffeners has to be increased on account of watertight doors in 'tween deck bulkheads, the stiffeners at the sides of the doorway are to be increased in depth and strength so as to provide efficiency at this neighbourhood at least equal to that of the unpierced bulkhead, without taking the door-frame into consideration. The frames of watertight doors are to be well fitted and strongly connected to the bulkhead.

Bulkheads are to be suitably strengthened at the ends of deck girders and where subjected to concentrated deck loads.

6. **Collision Bulkheads.**—The spacing of the stiffeners is not to exceed 24 inches, but the scantlings of stiffeners and thickness of plating is to be as required by **Tables 10, 10 A** and **10 C**, for stiffeners spaced 30 inches apart. The stiffeners may be fitted horizontally instead of vertically, provided equivalent strength and stiffness be obtained.

7. **Boundary Angles.**—The bulkheads are to be attached to the outside plating, decks, and inner bottom by single angles not less than ·10 inch thicker than the bulkhead plating required by the Table. These angles may be single riveted except where situated more than 24 feet below the top of the bulkhead, when they are to be double riveted. The flanges of the angles are to be not less than 3 inches for $\frac{3}{4}$ inch rivets, $3\frac{1}{2}$ inches for $\frac{7}{8}$ inch rivets, and 4 inches for 1 inch rivets, where single riveted, and 5 inches for $\frac{3}{4}$ inch and $\frac{7}{8}$ inch rivets, and 6 inches for 1 inch rivets where double riveted, as shown in sketches on page 181.

8. **Riveting.**—The rivets in seams, end connection of plating and boundary bars of bulkheads are to be spaced not more than $4\frac{1}{2}$ diameters centre to centre, except on the shell flange of boundary angles where they may be 5 diameters centre to centre. Where the distance below the bulkhead deck is more than 35 feet, the vertical connections of plates are to be double riveted. The rivets connecting stiffeners to bulkhead plating are to be spaced not more than seven diameters centre to centre, and in the case of stiffeners having no bracket attachment, they are to be spaced four diameters for 15 per cent. of their length from each end. In deep water ballast and peak tanks the rivets through the frames and outside plating are to be spaced not more that $5\frac{1}{2}$ diameters apart, centre to centre.

9. **Caulking and Watertightness.**—All watertight bulkheads are to be carefully caulked and their watertightness tested in accordance with paragraph 16.

Where frames pass through watertight decks, watertightness is to be maintained by means of caulked angle chocks, or by cast steel or cast iron chocks efficiently secured and rust jointed. Cast steel or cast iron chocks are not to be used at the deck over water ballast tanks. A stuffing box is to be fitted on the after peak bulkhead where the screw shaft passes through, and the bulkhead plating at this part is to be doubled or increased in thickness.

10. **Horizontal Brackets.**—Horizontal brackets are to be fitted connecting the transverse bulkheads to the side stringers, or to the shell plating where side stringers are omitted. These brackets are to be fitted two frame spaces in length on each side of the bulkhead and are to be ·06 inch thicker than the Rule thickness of the side stringer intercostal plates ; the width of the bracket is not to be less than one frame space measured from the inner edge of the frame. (*See* **Sketch,** page 166.)

11. **Watertight Recesses.**—Watertight recesses in bulkheads are to be framed and stiffened so as to provide equivalent strength and stiffness to that required for watertight bulkheads.

12. **Watertight decks and steps in bulkheads** are to have beams at every frame intermediate in strength between those required for lugged and bracketed stiffeners in **Tables 10** and **10 A**, except where such beams are fitted in short lengths bracketed at each end, when they may be of the strength required for bracketed stiffeners.

The horizontal plating is to be ·04 inch thicker than required for bulkheads under the same head from the top of the bulkhead or from the upper deck. In obtaining the necessary scantlings for beams and plating, account is to be taken of the spacing of the beams, and in no case are the sizes of these beams and thickness of plating to be less than required by **Sections 20** and **26** respectively of the Rules.

The rivet connections of pillars are to be sufficient to withstand the load due to water pressure.

In a cellular double bottom a watertight division is to be fitted at or near each bulkhead required by the Rules.

13. **Watertight longitudinal Bulkheads.** — Watertight longitudinal bulkheads are to be equal in strength and stiffness to transverse bulkheads of the same depth.

14. **Deep Water Ballast Tanks and Peak Tanks.**—The spacing of the stiffeners on the boundary bulkheads of all deep water ballast tanks is not to exceed 24 inches, but the thickness of the plating is to be as required by **Table 10 C** for a stiffener spacing of 30 inches.

The stiffeners are to be of the size required by **Tables 10** and **10 A** for stiffeners spaced 30 inches apart, but in this case the height above the top of the stiffener is not to be taken less than 12 feet.

The scantlings of beams and plating at the crown of the tank are to be obtained in accordance with paragraph 12, but the height above the top of stiffener is not to be taken less than 12 feet.

Where frames and reversed frames are cut at the tops of **peak tanks** of ordinary length, they are to be connected by brackets of the sizes given in the following table :—

Transverse Number.	Depth of bracket measured from outside plating.	Number of Rivets.
Above 23 and not exceeding 42	15 inches.	4 of $\frac{5}{8}$ inch.
„ 42 „ 54	18 „	4 „ $\frac{3}{4}$ „
„ 54 „ 63	21 „	5 „ $\frac{3}{4}$ „
„ 63 „ 75	24 „	6 „ $\frac{3}{4}$ „
„ 75 „ 87	27 „	7 „ $\frac{3}{4}$ „
„ 87 „ 99	30 „	7 „ $\frac{7}{8}$ „

Brackets are to be fitted at every frame of the same thickness as the frame. Where only the reversed frames are cut, and not the frames, the bracket attachments are to be fitted to alternate frames.

The side framing in deep water ballast tanks is to be additionally strengthened by means of a web frame fitted at about the middle of the length of the tank.

The boundary angles of the bulkheads are to be double riveted except at the deck, where they shall be single riveted.

An efficient wash plate is to be fitted at the middle line in all deep water ballast tanks and peak tanks. In deep tanks the wash plate is to be carried down the boundary bulkheads to form a web, and quarter pillars attached to an intercostal deck girder are to be fitted on each side of the middle line.

The air pipes are to be sufficient in number and size, and their total area should be at least equal to the area of the supply pipes. Wherever necessary, an air pipe should be fitted at each end of each tank on both sides of the vessel, and ample provision should be made for the free passage of air from one division to another so that it may readily find its way to the air pipes.

Where it is intended to carry fuel oil in deep tanks plans are to be specially submitted.

15. **Shaft Tunnel.**—The stiffeners are to be of the size required by **Table 10 D**, and spaced 36 inches apart. The foot of each stiffener is to overlap and be attached to the tunnel base angle in all cases. The flat plating is to be of the thickness required by **Table 10 C** for bulkhead plating with stiffeners spaced 36 inches apart, and the curved plating may be of the thickness required for bulkhead plating with stiffeners spaced 30 inches apart.

The top plating in way of the hatchways is to be not less than ·10 inch thicker than the remaining plates, or to be covered with wood not less than 2 inches thick.

The base angle is to be ·10 inch thicker than the flat tunnel plates and may be single riveted. Riveting and caulking is to be as required for bulkheads.

The tunnel is to be fitted with a watertight sluice door on the engine room bulkhead, capable of being closed from the upper deck. In vessels of a length of 250 feet and over, a watertight trunkway or escape of adequate size is to be fitted in the most convenient position leading from the tunnel to the deck.

If a pipe tunnel is led through the forward holds, its structure is to be the same as that of a shaft tunnel.

16. **Testing.**—On completion, ordinary watertight bulkheads, deck flats, and tunnels are to be hose tested under simultaneous inspection on both sides of the plating. The pressure of the water in the hose should be not less than 30 lbs. per square inch.

Fore and after peak bulkheads are to be tested by the peaks being filled with water to the height of the load water line.

Deep water ballast tanks and peak tanks are to be tested by a head of water 8 ft. above the top of the tank, but not less in any case than to the height of the load water line.

BEAMS.

Section 20. 1. It is recommended that the round up of the beams of all weather decks should be about one quarter of an inch per foot of length of beam, except when the longitudinal number exceeds 30,000 and at least half the length of the top continuous deck is covered by erections.

2. **Form of Beam Section.**—**Beams** are to be of the form and size given in **Tables 11, 12 and 13** (*see* also **Sketches**, pages 145 to 149), or they may be of other approved form of equal strength.

3. The beams of the various decks, or of tiers of beams, are to be placed over each other and, as far as practicable, to be fitted to the frames which have reversed frames extended to the upper deck.

4. **Beams** are to be fitted at **every frame**:—

(*a*) At all watertight flats.

(*b*) At upper decks of single deck vessels above 15 feet in depth.

(*c*) At unsheathed upper decks when a complete steel deck is required by the Rules, also at unsheathed bridge decks, awning or shelter decks. In vessels over 450 feet in length the beams of upper, awning or shelter decks are to be fitted at every frame whether the plating is sheathed or not. Upper decks in way of poops, forecastles, and bridges of vessels not exceeding 66 feet in breadth may have the beams fitted at alternate frames, except for one-tenth the vessel's length within each end of the bridge where they are to be fitted at every frame.

(*d*) Where no wood deck is laid on a steel or iron deck (required by the Rules) at sides of hatchways including those of engine and boiler room openings.

Elsewhere deck beams must in no case be spaced more than two frame spaces apart, and only when the frame spacing does not exceed 27 inches.

5. **Rows of Pillars.**—The number of rows of pillars is to correspond with the requirements of **Tables 11** and **12**. Where the length of the midship beams exceeds 44 ft. not less than two rows of pillars are to be fitted, and where the length exceeds 60ft. three rows are to be fitted. Where beams are at every frame, pillars are to be fitted at alternate beams and attached to continuous fore and aft girders under the beams. These girders are to be attached to each beam and to the bulkheads against which they abut, by short angles. For widely spaced pillars and girders at heads of same, *see* **Tables 15** and **16**, and **Sketches**.

Where **one row of pillars** is fitted, the **beams at the ends** of the vessel which do not exceed in length two-thirds that of the beam amidships, may be of the sizes required by the columns numbered **2** in **Tables 11** and **12**; and **beams at ends** which do not exceed half the length of the beam amidships may be of the sizes required by columns **3** in **Tables 11** and **12**.

Where **two rows of pillars** are fitted amidships the athwartship distance between the rows is to be about one-third the breadth of the vessel amidships; the **beams at the ends** which do not exceed two-thirds the length of the beam amidships, may be supported by one row of pillars, and be of the sizes required by columns **2**, and where the lengths of the **beams at the ends** do not exceed half the midship beam length the sizes may be as required by columns **3** if supported by one row of pillars.

Where **three rows of pillars** are fitted amidships, the athwartship distances between the rows of pillars is to be about one-fourth the breadth of the vessel amidships, and the beams throughout are to be of the sizes required for beams amidships by columns **3**; but where the lengths of the **beams at the ends** do not exceed three-fourths the length of the beam amidships, two rows of pillars may be fitted; and where the **beams at the ends** do not exceed half the midship beam length, one row of pillars may be fitted.

6. If **beams of bulb angle section** are fitted at alternate frames in vessels exceeding 34 feet in breadth, a steel or iron deck should be fitted on these beams.

7. The **hatch end beams of hatchways** above 10 feet in length are to be in accordance with **Section 32, paragraph 4.** The sizes of half beams in way of engine and boiler openings are to be determined as for half beams in way of hatchways. (*See* **Section 32, paragraph 5.**)

8. **Passenger decks.**—The beams of decks fitted exclusively for the accommodation of passengers may be of the size given for upper deck beams of the same length.

9. **"Strong" beams in the machinery space** of steamers are to have double angles on their upper and lower edges unless cross tie-plating is fitted on them, in which case only single angles need be fitted to the upper and lower edges of the beams.

10. **When it is intended to suspend cargoes** such as chilled beef by hanging them to the beams, the beams and beam girders should be of such extra strength as may be required by the Committee, in order to enable them successfully to resist the additional stresses brought upon them by this mode of carrying the cargo.

11. **Beam knees and bracket knees.**—Where plate knees are not fitted, beam knees are to be efficiently welded.

The depth and thickness of welded knees, and the depth, breadth, and thickness of bracket knee plates (*see* **Sketches,** page 167) for beams fitted at every frame are to be as required by **Table 11,** and for beams to alternate frames as required by **Table 12** for the respective decks, except in the following cases where the beam knees are to be as required by **Tables 11** and **12** for upper deck beams of steamers having the same midship length of beam and having one tier of beams only :—

(*a*) The upper deck beam knees where the beams below are widely spaced.

(*b*) The beam knees at watertight flats for deep tanks.

(*c*) The lower and orlop deck beam knees of sailing vessels.

12. In the **upper deck of large vessels** having no decks below, the beams at every frame are to have plate bracket knees as follows :—

Where the depth (**d**) of the vessel is

Above 23 ft. and does not exceed 24 ft. the knees are to be $33 \times 33 \times \cdot 50$ ins.
„ 24 „ „ 25 „ „ „ „ $36 \times 36 \times \cdot 52$ „
„ 25 „ „ 26 „ „ „ „ $39 \times 39 \times \cdot 54$ „
„ 26 „ „ 27 „ „ „ „ $42 \times 42 \times \cdot 54$ „

The 42 in. bracket knees are to be stiffened by being flanged on the inner edge.

13. Beam knees are to measure across the throats not less than six-tenths of the depths required for the knees.

14. **Riveting of beam knees.**—Not more than two holes are to be punched in each beam knee before the beam is properly adjusted in its position.

15. The number and size of the rivets in the beam knees, or in both arms of bracket plate knees, are to be sufficient to ensure the riveted parts being efficiently closed, and in no case to be less than given in the following table :—

Depth of Knee.	Number of rivets.	Diameter of rivets.
Not exceeding 17 inches.	4	$\frac{3}{4}$ of an inch.
Above 17 and „ 21 „	5	$\frac{3}{4}$ „
„ 21 „ „ 24 „	5	$\frac{7}{8}$ „
„ 24 „ „ 28 „	6	$\frac{7}{8}$ „
„ 28 „ „ 32 „	7	$\frac{7}{8}$ „
„ 32 „ „ 36 „	8	$\frac{7}{8}$ „
„ 36 „ „ 40 „	9	$\frac{7}{8}$ „

WIDELY SPACED BEAMS IN HOLD.

Section 21. 1. **A tier of beams in hold,** such that the depth (**d**) (**Section 2, paragraph 3**) may be taken between it and the top of floors to determine the scantlings of

transverse framing, must have the beams of the size given "for strong" hold beams by **Table 12**, and having a rider plate of at least the breadth and thickness of the beam plate.

These beams are to be fitted not lower than the middle of the depth of the hold and are to be spaced not more than 24 feet apart. They are to have a **broad hold stringer plate** riveted to the beam ends. The breadth and thickness of the stringer plate is to be as given below, and it is to be attached to the outside plating with double angles $3\frac{1}{2}'' \times 3\frac{1}{2}''$, and of the thickness of the stringer plate.

A bulb angle, or equivalent channel, face bar of the size given below is to be riveted to the inner edge of the stringer, and the stringer is to be supported by brackets at alternate frames. *See* **Sketch** on page 159.

L × (B + D)	Depth from Top of Floors to Top of Beam of Lowest Laid Deck at Side.		
	Feet. Above 21 not exceeding 23	Feet. Above 23 not exceeding 25	Feet. Above 25 not exceeding 27
Above 18200 not exceeding 26400	Inches. 60 × ·56	Inches. 64 × ·58	Inches. 68 × ·60
26400 „ 34800	64 × ·58	68 × ·60	72 × ·62
Bulb Face Angle	$11 \times 3\frac{1}{2} \times ·58$	$11\frac{1}{2} \times 3\frac{1}{2} \times ·60$	$12 \times 4 \times ·62$

2. Gusset plates, four frame spaces in length and of a breadth equal to one half their length, also of the thickness of the stringer plate, are to be fitted connecting the "strong" hold beams to the stringer plate; and brackets are to be fitted connecting the stringers to the bulkheads.

PILLARS.

Section 22. 1. **Pillars,** where fitted in accordance with the requirements of **Table 14**, may be of steel or iron of the sizes given therein. Where widely spaced pillars are fitted in accordance with the requirements of **Table 15**, they are to be of steel having a tensile strength of from 28 to 32 tons per square inch (as per **Section 3**). If steel of from 22 to 27 tons per square inch tensile strength be used for widely spaced hollow round pillars, the plates from which the pillars are to be made must be increased in thickness as shown in the footnote to the Table. Other approved forms of pillars than those shown in **Table 15** will be accepted, provided they are of equal strength. The number of rows of pillars is to correspond with the requirements of **Tables 14** and **15**, and **Section 20, paragraph 5.** Where the length of the midship beam exceeds 44 feet, not less than two rows of pillars are to be fitted, and where the length exceeds 60 feet, three rows are to be fitted. Where beams are at every frame, pillars are to be fitted at alternate beams and attached to continuous fore and aft girders under the deck.

The girders are to be attached to each beam, and to the bulkheads against which they abut, by short angles. For widely spaced pillars and girders at heads of same, *see* **Tables 15** and **16**, and **Sketches** on pages 168 to 173.

2. **Riveting of pillars.**—Pillars to beams are to be arranged between decks and in the holds so as to form continuous ties from the floors to the weather deck beams The heads of pillars are to be fitted close under the beams or girders, and the heels are also to be fitted close.

Where the lengths of pillars do not exceed 18 feet, and the diameters do not exceed 4 inches, the ends are to be attached by not less than two $\frac{7}{8}$ inch rivets. Where the lengths are above 18 feet and do not exceed 24 feet, or the diameters are above 4 inches and do not exceed 5 inches, there are to be not less than three rivets in each end of the pillars, and where the diameters of the pillars are above 5 inches, not less than four rivets are to be fitted.

3. The heels of pillars at inner bottoms are to be fitted and riveted to short tee or angle bars.

4. **In way of hatchways and other deck openings,** the pillars may be spaced four frame spaces apart, provided they be increased $\frac{1}{2}$ an inch in diameter above the sizes required for two rows of pillars by **Table 14.**

Where the pillars abreast the openings are more widely spaced, the sizes of these, as also the sizes of the hatch end pillars at the centre line, are to be in accordance with **Table 15**, and the grade number is to be obtained so as to take account of the load borne by each pillar. In such cases plans showing the arrangement and scantlings are to be submitted for approval.

5. **Pillars under widely spaced hold beams** may be of the sizes required for pillars of the same length under the deck next above the hold beams.

6. **Passenger decks.**—If the "second" deck is intended exclusively for the accommodation of passengers, the pillars between this deck and the floors may be $\frac{1}{4}$ inch less in diameter than required by the Tables; and where the deck next below is also intended for passengers exclusively, the pillars between this deck and the floors may be $\frac{1}{2}$ inch less than required by the Tables.

7. **Additional Pillaring.**—Under deck houses, heel of bowsprit, windlass, steam winches and capstans, the beams are to be additionally pillared.

8. Where **double pillars** are fitted for the purpose of securing shifting boards, they are not to be less than three fourths the diameter required for single pillars.

9. **When it is intended to suspend cargoes** such as chilled beef by hanging them to the beams, the pillars beneath such beams, and the supports under their heels, are to be of such extra strength as may be required by the Committee, in order to enable the pillars and the framing beneath them successfully to resist the additional stresses brought upon them by this mode of carrying the cargo.

10. **Pillars on a shaft tunnel.**—If pillars be fitted on a shaft tunnel, the tunnel should be strengthened in way of them, by doubling plates, angle bars, and a transverse vertical plate, or by other efficient means.

11. Where a **non-watertight middle line bulkhead** is fitted in lieu of a row of pillars, it is not to be less than $\frac{5}{16}$ of an inch in thickness if of iron, or ·30 of an inch if of steel, and connected at the bottom and to plating on the beams by single angles not less than $3\frac{1}{2}'' \times 3\frac{1}{2}'' \times ·40''$.

The vertical stiffeners are to be spaced not more than two frame spaces apart, and they are to be of the sizes given in the following Table. Where quarter pillars are fitted the size of these stiffeners may be modified subject to the approval of the Committee.

OVERALL LENGTH OF STIFFENER.		UNDER UPPER DECK.	UNDER SECOND DECK.	UNDER THIRD DECK.
Feet. Above / not exceeding		Inches.	Inches.	Inches.
6 and 8	ANGLES	$4\frac{1}{2} \times 3 \times ·36$	$5\frac{1}{2} \times 3 \times ·36$	$6 \times 3 \times ·36$
8 „ 10	ANGLES	$5 \times 3 \times ·36$	$6 \times 3 \times ·40$	$6\frac{1}{2} \times 3 \times ·38$
10 „ 12	ANGLES	$5\frac{1}{2} \times 3 \times ·38$	$6 \times 3 \times ·36$	$7 \times 3 \times ·42$
12 „ 14	ANGLES	$6 \times 3 \times ·40$	$7 \times 3 \times ·36$	$8 \times 3 \times ·42$
14 „ 16	BULB ANGLES	$6 \times 3 \times ·38$	$8 \times 3 \times ·40$	$9 \times 3 \times ·46$
16 „ 18	BULB ANGLES	$7 \times 3 \times ·38$	$9 \times 3 \times ·44$	$10 \times 3\frac{1}{2} \times ·50$
18 „ 20	BULB ANGLES	$8 \times 3 \times ·40$	$10 \times 3\frac{1}{2} \times ·48$	$11 \times 3\frac{1}{2} \times ·54$
20 „ 22	BULB ANGLES	$9 \times 3 \times ·42$	$11 \times 3\frac{1}{2} \times ·50$	$12 \times 3\frac{1}{2} \times ·60$
22 „ 24	BULB ANGLES	$9\frac{1}{2} \times 3\frac{1}{2} \times ·50$	$11\frac{1}{2} \times 3\frac{1}{2} \times ·56$	
24 „ 26	BULB ANGLES	$10 \times 3\frac{1}{2} \times ·54$	$12 \times 3\frac{1}{2} \times ·64$	
26 „ 28	BULB ANGLES	$11 \times 3\frac{1}{2} \times ·54$		
28 „ 30	BULB ANGLES	$12 \times 3\frac{1}{2} \times ·58$		

The stiffeners at the ends of hatchways are to be bracketed at top and bottom, and in cases where pillars at sides of hatchways are omitted, or are widely spaced, these stiffeners will require to be reinforced; the remainder of the stiffeners are to be riveted to the beams and attached at the bottom by double riveted lugs.

12. The **beams in the machinery space** are to be pillared where practicable. Quarter pillars to these beams may be dispensed with provided they are supported by straight bunker sides or casings not less than ·30 of an inch thick, having stiffeners extending from the lowest complete tier of beams to the inner bottom and spaced not more than two frame spaces apart. The stiffeners may be one inch less in depth than would be required for a middle line bulkhead. They are to be attached at their heels to the inner bottom by double riveted lugs and riveted at their heads to the beams and half-beams.

PLATING.

Section 23. 1. **Thickness.**—The thickness of the outside plating as given in **Tables 17** and **18**, for half the vessel's length amidships, is to be maintained for that length, and may thence be gradually reduced to the thickness given for the extreme ends.

The three strakes of outside plating next the keel are to have the midship thicknesses maintained forward to the collision bulkhead.

In single screw steamers the plates connected to the stern frame, and in twin screw steamers the plates connected to the "spectacle frame" and to the stern frame must be of the thickness required for the same strakes amidships. Plates on the "spectacle frame" of twin screw steamers, and on the boss of single screw steamers which are to be furnaced should be supplied of the thickness required for propeller boss plates in Table 17. The outside plating is to be of increased thickness or doubled in way of hawse pipes.

2. **Shift of butts.**—No butts of outside plating in adjoining strakes to be nearer each other than two spaces of frames; and the butts of the alternate strakes not to be under each other, but shifted not less than one frame space.

3. The butts of the upper, awning or shelter deck stringer plates are in all cases to be shifted not less than two frame spaces clear of the butts of the sheerstrakes.

4. The butts of the strakes next to the keel are to be shifted clear of the keel butts, or scarphs, and not to be nearer each other on opposite sides of the vessel than two frame spaces.

5. **Fitting and caulking of butts and edges.**—All flush butts of plating to be planed and fitted close ; all overlapped butts and edges of the plating to be sheared from the faying surfaces, or the "burr" caused by shearing to be carefully chipped off, and all outside edges of seams and lapped butts of plating are to be either planed or chipped fair. The butts and edges to be carefully caulked.

6. The **sheerstrake** to extend sufficiently above the upper deck beam ends to take at least two rows of rivets vertically in the butts above the upper flange of the gunwale angle bar.

7. **Breadths of strakes.**—The maximum breadths of strakes of outside plating for which the butt riveting required by **Table 21** is applicable are to be as follows :—

Depth (D) of vessel.	Maximum breadth of strake of plating.
Feet.	Inches.
Not exceeding 20	54
Above 20 and „ „ 24	60
„ 24 „ „ „ 28	66
„ 28	72

If it is proposed to use wider strakes of plating than the foregoing, the riveting of the butts is to be specially submitted.

8. Where it is proposed to cut **large openings** in the topside plating, efficient compensation is to be provided to the satisfaction of the Committee.

Bulwark Plating and Stanchions.

9. **Steamers.** — The stanchions which support the bulwarks in steamers are not to be more than 6 feet apart, and the stanchions nearest to the ends of a bridge or a long poop are not to be more than 5 feet from the bridge or poop bulkhead, and to be made additionally strong to the satisfaction of the Surveyors. The bulwark plating at these parts is to be increased in thickness and supported by bracket plates.

The continuity of strength is to be carefully ensured at the break of erections ; and gangways, doors, and other openings in the bulwark plating are to be kept well clear from these breaks. Freeing ports in bulwarks adjacent to the extremities of a bridge, or the front of a long poop, are to have rounded corners and substantial rims. When mooring pipes are fitted in bulwarks the plating in way of same must be doubled.

BUTT-STRAPS AND EDGE LAPS.

Section 24. 1. The breadth and thickness of butt-straps of outside plating, inner bottom plating, deck stringers, plating, floors, keelsons, &c., also the breadths of edge laps of the above, and the number of rows of rivets in such butt-straps and edge laps, together with the spacing of same, are to be as stated in **Tables 19, 20,** and **21.**

Lining Pieces.

2. The space between the plating and the frames to have solid filling or lining pieces of iron or steel in one length, closely fitted ; to be of the same breadth as the frames.

RIVETING AND RIVETS.

(See also **Tables 19, 20, and 21.**)

Section 25. 1. **Workmanship.**—The work is to be carefully closed with nut and screw bolts before the riveting is commenced. Unfair holes are to be properly rimed out and re-countersunk if necessary, and not to be cut with a chisel or unduly drifted. The rivets are to be properly staved up so as to completely fill the holes, their heads are to be "laid up" close, and the points or outer ends are to be left full and are not to be below the surface of the plating.

The Surveyors are to see that the rivet holes are properly formed, and the "burr" caused by punching must be removed before the parts are fitted together for riveting.

The rivet holes are to be regularly and equally spaced and carefully punched from the faying surfaces, opposite each other in the adjoining parts, laps, lining pieces, butt-straps and frames. The rivet holes in frames at the turn of the bilge are not to be punched until the frames are bent to the required shape ; the holes in way of the lands of the plating are to be drilled or "beared" after the frames are faired in place, and the plate edges lined off.

2. **Quality and Testing of Rivets.**—Rivets, whether of iron or steel, are to be of the best quality, and the Surveyors are to test samples of the rivets when delivered in the shipyards where they are to be used.

3. **Form of Rivet.**—The rivets are to be in diameter as required by **Tables 19** and **20,** and to be increased in size under their heads to fill the rivet holes. Those used for outside plating are to be of the form shown in **Table 20.**

4. **Countersinking.**—The countersinking of the rivet holes is to extend through the whole thickness of the plate or angle when the thickness does not exceed ·60 of an inch,

and when the thickness is above ·60 of an inch, the countersinking is to extend through nine-tenths the thickness of the plate. The size of the countersink is to be in accordance with the figured dimensions shown in **Table 20.**

5. **Arrangement of Rivets.**—The size and spacing of the rivets in the various parts of the structure are to be in accordance with the requirements of **Tables 19, 20,** and **21.** The butts of outside plating, and all double and treble riveting, except in the keel, stem and sternpost are to be chain riveted. The keel, stem and sternpost, the butts of outside plating, deck stringers and tie plates on beams, keelsons, stringers, and all longitudinal ties, are to be at least double riveted in all vessels. The butts of deck plating are to be at least double riveted for half the length amidships. The butts and edges of the plating of watertight bulkheads may be single riveted, except the seam connecting the bulkhead plating to floor plate, which must be double riveted.

6. **Number of Rows of Rivets in Seams of Outside Plating.**—The landing edges of outside plating when above ·36 of an inch in thickness from the keel to the upper turn of bilge, and when above ·48 of an inch from the upper turn of bilge to the gunwale, must be at least double riveted; below these thicknesses the edges may be single riveted.

Where the side plating is above ·84 inch in thickness the seams of the same are to be treble riveted for four-fifths the vessel's length amidships. The edges of the sheerstrakes are to be double riveted in all cases; except where the side plating is above ·84 of an inch in thickness, when they are to be treble riveted.

The thicker of the two plates is to regulate the size of the rivets and the requirements as to double riveting. When the plating is of a thickness amidships to require the edges to be double riveted, the same is to be continued all fore and aft.

In vessels above 480 feet in length, with side plating not more than ·84 inch in thickness, the landing edges are to be treble riveted for one-fourth of the vessel's length in the fore and after bodies for a depth of one-third the depth of the vessel, the actual position of this treble riveting to depend upon the arrangement of shell plating and the special design of the vessel; or other equivalent strengthening to be afforded.

Vessels of from 450 feet to 480 feet in length are to be additionally riveted at the before mentioned parts proportionately to their length, or to have other equivalent strengthening. Each case requiring this additional riveting of the seams is to be submitted for the approval of the Committee.

7. **Spacing of Rows of Rivets.**—The breadth of butt straps, butt laps and edge laps are to be in accordance with the requirements of **Tables 19** and **21.** The rivets are not to be nearer the butts or edges of the plating, butt straps, butt laps, or of any angle bar than a space equal to their own diameter.

In edge riveting the space between any two consecutive rows of rivets must not be less than once and a half their diameter.

In butt straps the space between any two rows must not be less than twice the diameter of the rivets, and in butt laps the space between consecutive rows is not to be less than two and a half times the diameter of the rivets.

8. **Doubling Plates.**—When plates have to be doubled the butts of these plates and of the doubling plates are to have the butt straps double or treble riveted, as may be required by **Table 21,** and in addition, these doubling plates are to be well riveted at the edges and middle of the plates between the frames, in addition to the rivets which pass through the frames, and the middle of the plates are to be riveted up before the edges.

DECKS.

Wood Decks.

Section 26. 1. The flat of decks, if of wood, to be of good quality, properly seasoned, free from sap and objectionable knots; the thickness to be as follows:—

Longitudinal Number $L \times (B + D)$.	At Upper Decks.		At Awning or Shelter Decks, and at Decks of Erections.	
	Thickness.		Thickness.	
	Pine.	Teak.	Pine.	Teak.
	inches.	inches.	inches.	inches.
Above 1200 and not exceeding 2400	$2\frac{1}{2}$	—	2	—
„ 2400 „ 3700	$2\frac{3}{4}$	$2\frac{1}{4}$	$2\frac{1}{4}$	—
„ 3700 „ 5200	3	$2\frac{1}{2}$	$2\frac{1}{4}$	—
„ 5200 „ 7000	$3\frac{1}{4}$	$2\frac{3}{4}$	$2\frac{1}{2}$	2
„ 7000 „ 8800	$3\frac{1}{2}$	3	$2\frac{3}{4}$	$2\frac{1}{4}$
„ 8800 „ 11800	$3\frac{3}{4}$	3	$2\frac{3}{4}$	$2\frac{1}{4}$
„ 11800 „ 82000	4	$3\frac{1}{4}$	3	$2\frac{1}{2}$

The thickness of a wood deck below an upper deck need not exceed $3\frac{1}{2}$ inches.

2. **Pitch Pine and Yellow Pine.**—Pine planks for weather decks should not be laid within a period of from four to six months (according to their thickness) after being cut; and where pitch pine is used for weather decks the breadth of the planks should not exceed 5 inches, and the period of seasoning should not be less than six months.

3. **Oregon Pine.**—Oregon pine of good quality will be admitted for decks of vessels, provided it be laid with the grain vertical, and the width of planks and period of seasoning be as required for pitch pine.

4. **Artificial Seasoning.**—The above required periods of seasoning will not be necessary in cases where satisfactory artificial means of seasoning are adopted.

5. The Surveyors must ascertain that the requirement as to the seasoning has been complied with.

6. The deck is to be laid and caulked to the satisfaction of the Surveyors.

7. When **gutter waterways** are adopted at the upper deck, the angle bar forming the inner edge of waterways is not to be less in thickness than

·50 where the thickness of the deck is 4 inches.
·44 „ „ „ „ $3\frac{1}{2}$ inches.
·40 „ „ „ „ 3 inches.

8. **Margin Planks.**—In sailing vessels, the margin or boundary planks of weather decks, adjacent either to the gunwale or to the gutter waterway at the gunwale, are to be either of Teak or Greenheart.

9. **Fastenings.**—When the deck planks are 6 inches in width or under, single fastening will be sufficient; but when they are above 6 inches and not exceeding 8 inches in width, there must be two bolts in each plank in every beam, one of which may be a short screw bolt; and planks exceeding 8 inches in width must be double fastened with nut and screw bolts.

10. The upper deck to be fastened by galvanised screw bolts with nuts at the under side of the angle bar of the beams and tie-plates. The bolts must be properly sunk, with oakum and white lead under their heads, and be carefully covered over with turned dowels bedded in white lead, marine glue, or other suitable composition.

Pine decks from 2 inches to $3\frac{1}{4}$ inches in thickness are to be fastened with bolts $\frac{1}{2}$ inch in diameter, and where the decks are from $3\frac{1}{2}$ inches to 4 inches in thickness, by bolts $\frac{5}{8}$ inch in diameter. Teak decks from 2 inches to $2\frac{3}{4}$ inches in thickness are to be fastened with bolts $\frac{1}{2}$ inch in diameter, and where the decks are from 3 inches to $3\frac{1}{4}$ inches in thickness, by bolts $\frac{5}{8}$ inch in diameter.

11. **Pads not to be used.**—Where diagonal plates are fitted on the beams, the deck planks are to be scored over the diagonal plates, so as to fit closely on the beams, thereby avoiding the use of wood pads.

Steel Decks.

12. **Steel decks** are to be fitted as required by **Tables 17** and **18** of the Rules.

13. Where the **beams at unsheathed iron or steel decks** required by the Rules are not fitted at every frame (*see* Sec. 20, par. 4), the thickness of the plating is not to be less than required by the following Table :—

Spacing of beams in inches	...	42 to 44	46 to 54
Thickness of plating amidships in inches	Steel ...	·36	·40
	Iron ...	$\frac{6}{16}$	$\frac{7}{16}$

14. **Continuity of Strength.**—Where a steel or iron deck is required by the Rules care should be taken to preserve the continuity of strength at all parts where local stiffness is unavoidably introduced. If intercostal girders are not adopted for the purpose of supporting the beams such girders are to be fitted to prevent local straining between the coamings of hatchways, engine and boiler room openings, deck houses, &c., at the amidship portion of steel or iron bridge, awning or shelter, and upper decks as well as of the deck next below an awning or shelter deck. They should be efficiently connected to the various coamings and casings by laps or brackets, or if not in line with these they should be made to scarph them by a sufficient distance.

15. **Steel Decks for one-half length.**—Where a steel deck is prescribed in **Table 18** to be fitted for one-half the vessel's length amidships, it is to be maintained the full breadth of the vessel for that length and then tapered gradually into the stringer plates for one-eighth the vessel's length at each end.

16. **Wood Sheathing.**—If a wood flat be laid over an iron or steel upper, awning, or shelter deck, the thickness of the sheathing need not exceed 3 inches, if of pine, and $2\frac{1}{2}$ inches, if of teak, and it should be efficiently secured between the beams to the deck plating. Steel or iron decks are not to be reduced in thickness from that given by **Tables 17** and **18**, when sheathed with wood.

The thickness of a wood flat laid over a steel or iron deck below an upper, awning or shelter deck need not exceed $2\frac{1}{2}$ inches.

Where Owners desire to use compositions intended as substitutes for wood sheathing on steel or iron decks, it is recommended that the steel or iron deck be coated with an approved insulating material, laid in a thin layer, hardened

and carefully examined for flaws and non-adherent patches before the wood substitute is applied; that there should not be any mechanical connection other than natural adhesion between the composition and the insulating material, or between the composition and the deck; and that the composition should be laid in sections sufficiently separated to allow for expansion, and the joints filled by the insulating material used below the composition.

It is further recommended that such compositions should not be fitted to weather decks, nor to any parts of other decks which may be subject to extreme moisture or extreme variations of temperature.

17. **Caulking.**—All decks of steel or iron are to be caulked, unless sheathed with a properly caulked wooden deck.

18. **Deck openings.**—Where large openings are cut in deck plating, compensation is to be given for the same.

Where steel or iron decks are fitted as required by the Rules the thickness of the plating must be increased so as to efficiently maintain the strength of the deck in way of all hatchways and engine and boiler openings, and, in addition, doubling plates are to be fitted at the corners of all large deck openings, or the deck plating increased in thickness equivalent to the doubling plate. (*See* also **Section 32, paragraph 6.**)

19. **Iron decks** will be admitted in lieu of steel decks provided the thickness of the plating be ten per cent. in excess of the thickness required by **Tables 17** and **18** for steel decks.

20. **Water Testing.**—All upper and weather decks of new vessels, of whatever material they are constructed, are, when complete, to have their watertightness tested by a hose in the presence of the Surveyors, who are to state in their First Entry Report the results of such tests.

All gutterways of new vessels are to be tested by being flooded with water, where possible, to ensure watertightness, and the Surveyors are to state in their First Entry Report the results of such tests.

STRINGERS ON BEAMS.

Section 27. 1. **Stringer plates** are to be fitted upon the ends of each tier of beams. Those upon the ends of the upper, awning or shelter deck beams to be of the breadth and thickness given in **Table 18**, and those upon the ends of deck beams below upper, awning or shelter decks to be as given in **Table 17**. Deck stringer plates are to maintain their midship breadth and thickness for one-half the vessel's length amidships; from thence the breadth and thickness may be gradually reduced to those given in **Tables 17** and **18** for the ends of the vessel. In way of a long bridge the upper deck stringer plates may be reduced in thickness as shown by **Table 18**. The stringer plates on widely spaced beams in hold to be as given in **Section 21.**

2. The stringer plates on all deck beams are to be fitted home and riveted to the outside plating, all fore and aft, with angle bars of the dimensions required by **Tables 17** and **18.** The stringer plates of all decks below the upper, awning or shelter decks are to have an additional angle bar of the same dimensions fitted inside the reversed frames and extending all fore and aft. For stringer angles on widely spaced hold beams *see* **Section 21.**

3. When the frames are extended through the upper deck stringer plate to form frames for bridges, poops and forecastles, there must be a continuous angle bar, of the size given in **Table 17**, wrought on the upper deck stringer plate inside the frames.

4. The upper deck stringer angle bar is in all cases to be fitted on the upper side of the stringer plate.

5. When gutter waterways are fitted to upper decks in vessels having poops or forecastles, the angle bars forming the ends of the gutters are to be welded, and the gutters to be carefully caulked.

TIE-PLATES ON BEAMS.

Section 28. 1. Where there are no steel decks laid, **tie-plates** are to be fitted on the beams, extending all fore and aft upon each side of the hatchways. Upon deck beams below the upper deck, on which no deck is laid, double angle bars of the sizes given in **Table 17** for beam stringer angles, placed at middle line or at each side of the hatchways, will be admitted in lieu of plate ties.

2. The tie-plates are to be of the width and thickness given in **Tables 17** and **18**, for half the vessel's length amidships, tapered at the ends to the same thickness as the ends of the stringer plates. They are to be well riveted to each other and to the beams and stringers.

HOOKS AND CRUTCHES AND PANTING ARRANGEMENTS.

Section 29. 1. **Spacing of stringers at ends.**—Stringers, where practicable, are to extend all fore and aft, and to be efficiently connected at their ends with plates forming hooks and crutches of the same thickness as the floor-plates

amidships, and those below the hold beams are to be spaced about 4 feet apart. In vessels whose longitudinal number is above 18,200, an additional hook or crutch should be fitted at the ends of the vessel, between each tier of beams, to the satisfaction of the Surveyors.

2. **Beams in peaks.**—Tiers of beams are to be fitted throughout the depth of peaks, the tiers being spaced not more than 8 feet apart.

3. All vessels to have, in addition, provision made to prevent panting, by means of an extra tier or tiers of beams, also by bracket knees, and stringer plates, fitted abaft the collision bulkhead.

4. Where a vessel has considerable sheer, additional transverse strength in the form of beams or otherwise is to be provided, having regard to the form of the vessel.

5. Panting beams and stringers are to be fitted at the after end of vessel where considered necessary by the Surveyors. Sketches of panting arrangements are in all cases to be submitted for approval. The stringer plates fitted below the lowest laid deck at the fore part of the vessel to prevent panting are to be worked intercostally between the frames, to be riveted to the panting beams, to be connected to every frame by a bracket knee, and to be attached to the outside plating by double angles, or by single angles with flange sufficiently broad to admit of double riveting.

ENGINE AND BOILER SPACE.

Section 30. 1. **Engine and Boiler bearers.**—In steam vessels care must be taken that the engine and boiler bearers are properly constructed, and fitted with efficient longitudinal ties. Where the bearers interfere with the longitudinal strength of the vessel, they must extend a sufficient distance beyond the bulkheads of the engine and boiler space to compensate for the same.

When engines of high power are fitted.—Where it is intended to fit engines of greater power than in ordinary cargo carrying steamers, the engine seating is to be of proportionately greater strength, and to be specially adapted with this object in view by being connected to the sides of the vessel. Other means are, if necessary, to be adopted in order to ensure the rigidity and strength necessary to withstand the vibration produced in this part of the vessel.

2. **Strengthening in machinery space.**—Additional strengthening by means of web frames, and "strong" beams, or otherwise is to be provided in the machinery space. Plans showing the proposed additional strengthening are to be submitted for approval.

3. **Clearance between bulkheads and boilers.**—Coal bunker bulkheads are to be kept well clear of the boilers and their uptakes. Where the boiler room bulkhead is recessed for a donkey boiler, the recess is to be of a size sufficient to give space all round the boiler to admit of its being properly attended to.

In order to afford protection against the heat from the boiler, the roof of the recess is to be not less than 4 feet clear of the top of the boiler, the space between the bunker or hold bulkhead plating and the chimney is to be not less than 18 inches, and a baffle plate is to be fixed between the chimney and the bulkhead; other efficient means may be provided. Wood lining is to be fitted on the hold side of the recess plating with an air space between it and the plating.

4. **Tie-beams across recess.**—When a recess extending above the hold beams is formed in the engine room bulkheads, the bulkhead is to be efficiently connected from side to side by a tie or bridle beam at about the height of the hold beams, strongly riveted to the plating and fitted with efficient gusset plates.

5. **Protection of deck under donkey boilers.**—Where vertical donkey boilers are placed on the decks of vessels, the deck underneath them is to be protected by being covered with firebrick or cement not less than 2 inches in thickness. The deck on which fires may be drawn from any donkey boiler is also to be protected by firebrick or cement not less than 2 inches in thickness.

ENGINE AND BOILER OPENINGS.

Section 31. 1. **Framing of openings.—The engine and boiler openings** of the weather deck of steam vessels are to be properly framed for a height of not less than 18 inches above the deck, the coaming plates to extend to the lower edge of the beams, and iron or steel casings connected to the coamings should be fitted to a height of about 7 feet above the deck.

In awning or shelter, and part awning deck vessels the height of the casing need not exceed 4 feet 6 inches above the deck, provided suitable iron covers be fitted, and the openings have coamings on the top of the casings not less than 9 inches in height.

The thickness of the casings, where exposed, to be not less than that required for the side plating of poops, and to be efficiently stiffened by vertical angles spaced 30 inches apart, connected to the coaming plates. The thickness of the coamings to be ·06 of an inch more than required for the casings.

Where the casings are enclosed by a bridge, and efficiently protected from the force of the sea, a reduction from the above thickness might be admitted, provided in such cases a plan showing the proposed arrangement be furnished for approval.

2. **Trunk casings.**—The engine and boiler openings in the 'tween decks of all vessels are also to be enclosed by trunk casings efficiently stiffened by angle bars 30 inches apart, and extending to the weather deck beams, to which they are to be secured.

3. **Strong iron doors** will be allowed in these trunk casings, provided their lower parts are at least 18 inches above the deck, and efficient arrangements made for their security.

4. **Height of coamings.**—When a poop, or bridge, covers the engine and boiler space, the coaming of the engine and boiler openings should not be less than 2 feet above such deck, unless these openings are constructed as provided for in the first paragraph of this Section.

5. The **engine and boiler openings** should be made as **small as practicable,** and be subdivided by athwartship iron divisional bulkheads. The two sides of the casing should in all instances be efficiently connected by angle beams within them at the upper part.

6. **Skylights and gratings.**—The engine-room skylights are to be substantially constructed, and to be securely bolted or riveted to the coamings, and where the skylight top is not solid, with bull's eyes fitted in the same, efficient deadlights must be provided. The grating openings over the stokehold must also be protected by plates, fitted with hinges, or otherwise in a manner satisfactory to the Surveyors.

7. **Plating in way of openings.**—Where either of the openings exceeds 15 feet, or the combined length exceeds 30 feet, the beams in way of the same are to be plated over from the stringer to the tie-plates, the plating extending two beam spaces beyond the openings, and tapered from thence towards the stringer plate for a distance not less than the breadth of the plating required to be fitted.

8. Where **large openings** are adjacent to each other, the intervening space between the openings is to be plated over.

9. **Steam Trawlers.**—In all steam trawlers the deck beams should be wholly plated over in way of the engine and boiler casings, and the casings should extend down to the underside of the deck beams, and be connected to the deck plating with angle bars and to the half beam ends with angle lugs. If the casings be not extended down to the underside of the beams, they should be attached to the deck plating with angles $4\frac{1}{2}'' \times 4\frac{1}{2}'' \times \cdot 36,''$ having two rows of rivets in each flange. In order to ensure that the scantlings and construction of these casings are satisfactory in every case, detailed plans of the same should be submitted for approval.

HATCHWAYS.

Section 32. 1. **Height of Coamings.** — The minimum height of coamings above decks to be as follows :—

On upper, awning, and raised quarter decks where exposed to weather ...		24 inches.
On decks of superstructures (other than awning decks) where exposed to the weather... ...	When within $\frac{1}{4}$ of the vessel's length from the stem ...	24 „
	When aft of the above ...	18 „
On decks inside superstructures the openings in the latter having no means of closing		18 „
On decks inside superstructures the openings in the latter being closed by strong hinged wood doors or wooden shifting boards fitted in channels or equivalent		9 „

On decks below the upper or awning deck, or within an intact superstructure, the coaming plates need not extend above the deck, but in such cases an angle coaming should be fitted round these hatchways ; all openings in decks are required to be framed.

2. **Thickness of Coamings.**—

In hatchways on the upper deck or on superstructure decks the side and end coamings are to be not less than ·44 of an inch in thickness.

In hatchways below the upper or awning deck or within an intact superstructure the side coamings are not to be less than ·50 of an inch in thickness and if end coamings are fitted to these hatchways they may be ·40 of an inch in thickness. Where the overhead height of 'tween decks exceeds 8 feet 6 inches, the side coamings will require to be of additional thickness.

3. **Construction of Coamings.**—Companions on exposed decks within a quarter of the vessel's length from the stem, and all hatchway coamings are to be of steel. The angles connecting the side and end coamings are to be of the thickness of the side coamings.

Angles connecting coamings and deck plating are to be of the thickness of the coamings to which they are attached,

and where a wood deck is fitted, the vertical flange is to extend half-an-inch above such deck.

Hatchway coamings which are required by **paragraph 1** of this Section to extend above the deck are to be caulked and made watertight, and the angles connecting these hatchway coamings to the deck plating are to be welded at the corners.

The side coamings of all hatchways are to extend to the lower edge of the hatch end beams; the end coamings of exposed hatchways should be carried down below the deck and riveted to the hatch end beams.

Hatchway side coamings, which are 24 inches or more in height above the deck and which are above 10 feet in length, are to be stiffened by horizontal bulb angles not less than 7 inches in depth fitted near their upper edges. Where hatchways exceed 10 feet in breadth, the end coamings are to be similarly strengthened or be equivalent thereto. Where the coamings are above 30 inches in height, additional support is to be afforded by fitting brackets or stays from the bulb angle to the deck at intervals of not more than 10 feet. Where the coamings are 36 inches in height and above, plans showing the construction are to be submitted for approval.

In hatchways above 10 feet in length the side coamings should be strengthened on their lower edge by flanging the same under the half beams for a breadth of 6 inches (or other equivalent means may be adopted); no additional strengthening to the coamings will be required where the pillars abreast the hatchways are fitted within 18 inches of the coaming and are spaced 4 frame spaces apart.

Where, however, the pillars are wider spaced, thus requiring a girder at their heads as per **Table 16**, or where the line of pillars at sides of hatchways is more than 18 inches from the coamings, the coamings will require to be made sufficiently strong as a girder to support the deck loads in way of the girder, and plans of such cases are to be submitted for approval. If this additional stiffening be provided by increasing the flange beyond 6 inches, bracket supports are to be fitted two frame spaces apart connecting the half beams to the flange and coaming; these brackets should also be fitted to other similar types of coaming girders.

4. **Hatch End Beams.**—Beams at ends of hatchways above 10 feet in length are to be not less than the size required by **Table 12** for beams to alternate frames for their respective decks.

Where the system of pillaring abreast the hatchways is such that the side coamings have been strengthened to act as girders and no corner pillars are fitted, the hatch end beams will require to be specially considered, and in such cases plans are to be submitted for approval.

5. **Half Beams.**—The size of the half beams is to be determined by the breadth of the deck amidships and by the greatest length of unsupported beam abreast the hatchways, and is to be obtained by interpolation from the sizes given in **Tables 11** and **12** for beams supported by one, two, and three rows of pillars.

Where half beams are fitted to alternate frames, they are to be connected to the coaming plates with double angles; half beams fitted to every frame may be connected to the coaming plates with single angles of not less thickness than the side coaming plates. There are to be three rivets in each flange of the angles connecting coamings to the half beams where the depth of the half beam is $7\frac{1}{2}$ inches to $9\frac{1}{2}$ inches and four rivets where the depth is 10 inches to 12 inches. Where bracket supports are fitted in accordance with **paragraph 3** above, the angle attaching the bracket to the coaming should be carried down for the full depth of the coaming.

6. **Construction in way of hatchways.**

Where there are no steel or iron decks, plates are to be fitted and riveted to the hatch end beams in order that the ends of the wood deck may be properly fastened and the side coaming plates are to be connected to plates of the thickness required for tie plates. In way of hatchways above 16 feet and not exceeding 22 feet in length, the fore and aft tie plates are to be double the width of those given in **Tables 17** and **18** for a length extending two frame spaces beyond each end of the hatchway.

On the upper and awning decks (and deck above if fitted) hatchways above 22 feet in length are to have the beams abreast the hatchway plated over, the plating to be tapered before and abaft to the stringer plate.

Where steel or iron decks (required by the Rules) **are fitted,** the thickness of the plating must be increased so as to efficiently maintain the strength of the deck in way of all hatchways or other openings, and, in addition, doubling plates are to be fitted round the corners of all large deck openings, or the deck plating increased in thickness equivalent to the doubling plate.

Where hatchways exceed 30 feet in length or 20 feet in breadth or are of **great length and breadth** relative to the dimensions of the vessel, plans are to be submitted for approval showing how it is proposed to provide the necessary strengthening in way of same.

The **pillaring** in way of hatchways is to be in accordance with **Section 22.**

7. **Hatchway beams and fore and afters** are to be of the sizes given in **Table A** (*see page* 51), and are to be so spaced that the unsupported length of the hatch covers does not exceed 4 feet 6 inches in all hatchways, except in the following cases:—(*a*) hatchways of a superstructure deck (other than an awning deck) where exposed to the weather and situated abaft one quarter of the vessel's length from the stem, and (*b*) hatchways in spaces fitted exclusively for the accommodation of passengers—where they may be of the sizes given in **Table B** (*see page* 52) and so spaced that the unsupported length of hatch covers does not exceed 5 feet 6 inches.

In no case are hatchway beams to be more than 10 feet apart.

Hatchway beams.—The web plate beams are to be stiffened at their upper and lower parts by double angles as required by **Tables A** and **B**; the angles at the upper parts are to extend to the extreme ends in all cases and are not to be recessed to form bearers where fore and afters are fitted.

The ends of the web plates are to be flushed up on each side by doubling plates having the same thickness as the angle mountings and at least 7 inches wide.

Where no fore and afters are fitted, the alternate web plates are to extend to the top of the wood hatches.

Steel fore and afters are to have angle mountings at the upper parts as required by **Tables A** and **B**, and these mountings are to extend to the extreme ends in all cases. Bearing pieces of heavy angle bar are to be fitted on the lower edge in way of each hatchway beam which they cross.

Wood fore and afters are to be of pitch pine, or other wood of not less hardness and strength, free from defects and are to be cut from the solid wood. Steel shoes at least $7 \times \cdot 5$ inches are to be fitted at each end of wood fore and afters, and plate bearing pieces at least $9 \times \cdot 5$ inches in way of each hatchway beam which they cross.

8. **Carriers.**—All hatchway beams and fore and afters are to be efficiently supported at their ends by steel carriers, with a length of bearing of not less than 3 inches; they are to be fitted close to the sides and throat of the hatchway beams and fore and afters. Where carriers are of angle bars they are to be not less than $\frac{1}{2}$ an inch in thickness, and those on the side coamings are to be carried down at least to the level of the deck.

Where fore and afters extend across hatchway beams, strong lugs are to be fitted on the beam to keep the fore and afters in position.

The bottoms of all carriers are to be solid, or are to be efficiently secured by not less than two $\frac{7}{8}$ inch rivets.

9. **Hatch Covers** are to be fitted to the hatchways in way of all laid decks, they are to be solid, not less than $2\frac{1}{2}$ inches thick, except those on non-exposed hatchways which may be of grating of sufficient strength.

10. **Hatch Rests** are to be at least $2\frac{1}{2}$ inches wide, where fore and afters are fitted, and where necessary the hatch covers are to be bevelled so as to provide bearing surface of not less than that width. Where no fore and afters are fitted, the hatch rests on the end coamings are to be at least 3 inches wide.

11. **Cleats, Battens, and Tarpaulins.**—Cleats not more than 2 feet apart centre to centre are to be fitted to the coamings of all hatchways on or above the upper or awning decks, unless such hatchways are within an intact superstructure; the end cleats are to be placed not more than 6 inches from the hatchway corners. They are to be of strong section at least $2\frac{1}{2}$ inches wide and are to be riveted by not less than two rivets.

The battens, wedges, and tarpaulins are to be efficient for their purpose and in good condition.

12. **Bunker, Trimming, and Escape Hatchways.**—The minimum heights of coamings of these hatchways are to be in accordance with **paragraph 1**, and covers, beams, and battening down arrangements as effective as those required for cargo hatchways must be fitted.

If the deck beams in way of these openings are cut, fore and after coaming plates are to be fitted to take the beam ends.

13. **Flush Bunker Scuttles** may be fitted in positions which are always accessible on decks inside superstructures, when the openings in the latter are closed by strong hinged wood doors or wooden shifting boards fitted in channels; they should be made of steel and of the screw down type.

14. **Trunked Hatchways.**—Where hatchways are trunked through one or more 'tween decks and the hatchway beams and covers are dispensed with at the intermediate decks, the hatchway beams, fore and afters, coamings, and deck immediately below the trunk are to be adequately strengthened, and in such cases plans are to be submitted for approval.

Where the trunkways are intended to take the place of 'tween deck pillars in way of the hatch, they are to be of steel efficiently stiffened.

Table A.

Web Plate Beams.

Breadth of Hatchway.	Without Fore and Afters. Spacing Centre to Centre. 4 ft.	Without Fore and Afters. Spacing Centre to Centre. 5 ft.	With Fore and Afters. Spacing Centre to Centre. 6 ft.	With Fore and Afters. Spacing Centre to Centre. 8 ft.	With Fore and Afters. Spacing Centre to Centre. 10 ft.	Double Angles on Upper and Lower Parts.
Feet.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.
10	9 × ·30	10 × ·30	11 × ·30	12 × ·32	14 × ·34	3 × 3 × ·40
12	10 × ·30	11 × ·30	12 × ·32	14 × ·34	17 × ·36	3 × 3 × ·40
14	11 × ·30	12 × ·32	14 × ·34	17 × ·36	20 × ·38	3 × 3 × ·42
16	12 × ·32	14 × ·34	16 × ·36	19 × ·38	22 × ·38	3½ × 3 × ·42
18	14 × ·34	16 × ·36	18 × ·36	21 × ·38	25 × ·40	4 × 3 × ·44
20	15 × ·34	18 × ·36	20 × ·38	24 × ·40	28 × ·42	4 × 3 × ·44

The depths are measured from the top edge of uppermost mounting to lower edge of lower mounting at the middle of the beam.
The depth at the ends is to be one half of the depth at the middle, but in no case less than 6 inches.
The larger flanges of the mounting angles are to be fitted horizontally.

Centre Fore and Afters. †

Length of Fore and After.	Steel Bulb Plate. Spacing of Fore and Afters. 3 ft.	Steel Bulb Plate. Spacing of Fore and Afters. 4 ft.	Steel Bulb Plate. Spacing of Fore and Afters. 5 ft.	Steel Bulb Plate. Double Angles on Upper Edge.	Wood. Spacing of Fore and Afters. 3 ft. Depth.	3 ft. Breadth.	4 ft. Depth.	4 ft. Breadth.	5 ft. Depth.	5 ft. Breadth.
Feet.	Inches.	Inches.	Inches.	Inches.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.
6	6 × ·36	6½ × ·38	7 × ·38	2½ × 2½ × ·36	5½	7	6	7	6½	7
8	7 × ·42	8 × ·44	9 × ·44	2½ × 2½ × ·38	6½	7	7½	7	8	7
10	8 × ·50	9½ × ·50	11 × ·50	2½ × 2½ × ·40	8	7	8½	8	9	9

Side Fore and Afters. †

	Steel Bulb Angle. Spacing of Fore and Afters. 3 ft.	Steel Bulb Angle. Spacing of Fore and Afters. 4 ft.	Steel Bulb Angle. Spacing of Fore and Afters. 5 ft.	Steel Bulb Angle. Angle on Upper Edge of Bulb Angle.	Wood. Spacing of Fore and Afters. 3 ft. Depth.	3 ft. Breadth.	4 ft. Depth.	4 ft. Breadth.	5 ft. Depth.	5 ft. Breadth.
	Inches.	Inches.	Inches.	Inches.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.
6	6 × 3 × ·36	6½ × 3½ × ·38	7 × 3½ × ·38	2½ × 2½ × ·36	5½	5½	6	6	6½	6
8	7 × 3½ × ·42	8 × 3 × ·44	9 × 3½ × ·44	2½ × 2½ × ·38	6½	6½	7½	7	8	7
10	8 × 3½ × ·50	9½ × 3½ × ·50	11 × 3½ × ·50	2½ × 2½ × ·40	8	7	8½	8	9	9

† Depths of fore and afters are measured to under side of covers, and the bulb plate of the centre fore and after is to be extended to the top of the wood covers.

Sizes for intermediate lengths and spacing may be obtained by interpolation.
Where the height of 'tween decks overhead exceeds 8 feet 6 inches these scantlings are to be suitably increased.

Table B.

WEB PLATE BEAMS.

Breadth of Hatchway.	Without Fore and Afters. Spacing centre to centre. Feet. 4	Without Fore and Afters. Spacing centre to centre. Feet. 5	With or Without Fore and Afters. Feet. 6	With Fore and Afters. Spacing centre to centre. Feet. 8	With Fore and Afters. Spacing centre to centre. Feet. 10	Double Angles on Upper and Lower Parts.
Feet	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.
10	9 × ·30	9 × ·30	9 × ·30	10 × ·30	11 × ·32	3 × 3 × ·40
12	9 × ·30	10 × ·30	10 × ·30	11 × ·30	13 × ·34	3 × 3 × ·40
14	10 × ·30	11 × ·30	11 × ·30	13 × ·32	15 × ·34	3 × 3 × ·42
16	11 × ·30	11 × ·30	12 × ·32	15 × ·34	17 × ·36	3½ × 3 × ·42
18	11 × ·30	12 × ·32	14 × ·32	17 × ·36	19 × ·38	4 × 3 × ·44
20	12 × ·32	13 × ·34	16 × ·34	19 × ·38	21 × ·38	4 × 3 × ·44

The depths are measured from top edge of upper mounting to lower edge of lower mounting at the middle of the beam.
The depth at the ends is to be one half the depth at the middle, but in no case less than 6 inches.
The larger flanges of the mounting angles are to be fitted horizontally.

CENTRE FORE AND AFTERS. †

Length of Fore and After.	Steel Bulb Plate. Spacing of Fore and Afters. Feet. 3	Steel Bulb Plate. Spacing of Fore and Afters. Feet. 4	Steel Bulb Plate. Spacing of Fore and Afters. Feet. 5	Double Angles on Upper Edge.	Wood. Spacing of Fore and Afters. Feet. 3 Depth.	Feet. 3 Breadth.	Feet. 4 Depth.	Feet. 4 Breadth.	Feet. 5 Depth.	Feet. 5 Breadth.
Feet.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.
6	5 × ·34	5½ × ·34	6 × ·36	2½ × 2½ × ·36	5	7	5½	7	6	7
8	6 × ·38	7 × ·40	7½ × ·42	2½ × 2½ × ·38	6	7	6½	7	7	7
10	7 × ·44	8 × ·46	9 × ·50	2½ × 2½ × ·40	7	7	7½	7	8	7

SIDE FORE AND AFTERS. †

	Steel Bulb Angle. Spacing of Fore and Afters. Feet. 3	Steel Bulb Angle. Spacing of Fore and Afters. Feet. 4	Steel Bulb Angle. Spacing of Fore and Afters. Feet. 5	Angle on Upper Edge of Bulb Angle.	Wood. Spacing of Fore and Afters. Feet. 3 Depth.	Feet. 3 Breadth.	Feet. 4 Depth.	Feet. 4 Breadth.	Feet. 5 Depth.	Feet. 5 Breadth.
	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.	Inches.
6	5 × 3 × ·34	5½ × 3 × ·34	6 × 3 × ·36	2½ × 2½ × ·36	5	5	5½	5	6	5
8	6 × 3 × ·38	7 × 3 × ·40	7½ × 3 × ·42	2½ × 2½ × ·38	6	5	6½	6	7	6
10	7 × 3 × ·44	8 × 3½ × ·46	9 × 3½ × ·50	2½ × 2¼ × ·40	7	6	7½	7	8	7

† Depths of fore and afters are measured to under side of covers, and the bulb plate of the centre fore and after is to be extended to the top of the wood covers.

Sizes for intermediate lengths and spacing may be obtained by interpolation.

MASTHOLES.

Section 34. In way of mast wedging, where iron or steel decks are not fitted, plates are to be riveted to the beams of not less thickness than is required for stringer plates amidships, and of not less width than three times the diameter of the mast. In steamers the mast ring is to be of plain angle of not less size than the bulb angle frames required in peaks.

VENTILATORS.

Section 35. 1. **Number and Size.**—It is recommended that ventilators, sufficient in number and size, be efficiently fitted to upper decks of all vessels.

2. **Ventilator Coamings.**—Where exposed to the weather the minimum height of coamings to be 36 inches on upper, awning and raised quarter decks and on the first superstructure deck above the upper deck when within $\frac{1}{4}$th of vessel's length from stem. For the remainder of the first superstructure deck (excluding awning decks) above the upper deck, the minimum height of coaming is to be 30 inches.

If ventilator coamings are fitted of a greater height than 36 inches and are not efficiently supported by adjacent structures, they are to be strongly stayed or bracketed to the deck.

The scantling of the coamings and their attachment to the deck should be in accordance with the following Tables :—

VENTILATOR COAMINGS.

Internal Diameter of Ventilator Coaming. In Inches.	Coaming Plate.	Deck Bar.
6 and not exceeding 9	·30	3 × 3 × ·36
Above 9 „ 12	·32	3 × 3 × ·38
„ 12 „ 16	·36	$3\frac{1}{2} \times 3\frac{1}{2} \times ·44$
„ 16 „ 18	·38	$3\frac{1}{2} \times 3\frac{1}{2} \times ·44$
„ 18	·40	$3\frac{1}{2} \times 3\frac{1}{2} \times ·44$

ATTACHMENT TO DECK.

Internal Dia. of Vent. Coaming.	Dia. of Rivet.	No. of Rivets in vertical flange.	No. of Rivets in horizontal flange.
Inches.	Inches.		
12	$\frac{3}{4}$	11	15
13	„	12	16
14	„	13	18
15	„	14	19
16	$\frac{7}{8}$	14	20
17	„	15	21
18	„	15	22
19	„	16	23
20	„	18	25

In ventilators less than 12 inches in diameter the rivets are to be $\frac{3}{4}$ inch diameter spaced 4 diameters centre to centre.

A steel ring should be riveted to the outside of the coaming to provide a proper bearing for the cowl, and the housing should be equal to the diameter of the ventilator but need not exceed 15 inches.

On unsheathed decks the coaming is to be riveted to the deck plating.

In cases where a steel deck is sheathed with wood the coaming is to be riveted direct to the steel deck, and the vertical flange of the bar is to extend at least half an inch above the wood sheathing, except in the case of ventilators to accommodation spaces which are 9 ins. in diameter and under, when the coamings may be bolted through the wood sheathing to the deck plating underneath.

3. **Stiffening of Deck below Ventilators.**—Where the thickness of the deck plating is less than ·40 inch, a doubling plate of a length and breadth not less than twice the diameter of the ventilator, and not less than ·30 inch in thickness is to be fitted, or other suitable stiffening is to be fitted in lieu of this local doubling. Where there is no steel or iron deck fitted, a plate of breadth equal to twice the diameter of the ventilator, and ·40 inch thick is to be riveted to the deck beams to take the coaming angle.

Where beams are fitted on alternate frames and the ventilator is over 12 ins. in diameter, an efficient fore and aft angle bar strongly connected to the beams is to be fitted on each side of the ventilator coaming.

4. **Covers.**—All ventilator coamings are to be provided with strong plugs and canvas covers or equally efficient appliances for closing the openings when the cowls are unshipped.

5. **Mushroom and gooseneck.**—Such ventilators when fitted to accommodation spaces should be substantially constructed and efficiently bolted to the deck plate.

6. **Scuttles in topsides.**—When scuttles are fitted in the topsides of vessels, strong covers for them are to be provided ; these covers to be efficiently fitted, to the approval of the Surveyors.

7. **Compensation for cutting side scuttles.**—Where scuttles are fitted in the sheerstrake within three-fifths of the vessel's length amidships, compensation is to be given either by an extra thickness in the sheerstrake doubling plate in way of the scuttles, or else by the introduction of strong angle bars over them.

8. **Alternative arrangements.**—Should the owners desire it, other arrangements proportionate to those prescribed in this Section may be adopted subject to the approval of the Committee.

PORTS AND SCUPPERS.

Section 36. 1. All vessels must be fitted with a sufficient number of **freeing ports** and **scuppers**, to readily discharge any large quantity of water from the upper deck. The ports and flaps, where such are adopted, are to be hung by strong hinges with yellow metal pins, and the scuppers formed in the vertical flange of the upper deck stringer angle bar, which is to be increased in depth so as to enclose the scuppers; or any other equally efficient plan may be adopted.

2. Where the bulwark plating and main rail are cut through to form a gangway or cargo port, the **bulwark stays** at each end of the port should be of increased strength, to the satisfaction of the Surveyors.

3. A sufficient **number of scuppers**, with proper pipes attached to them, are to be fitted in all 'tween decks below upper deck to convey water or leakage to the bilges.

4. In "Well deck" vessels, the **freeing port area** in the "Well" should be in accordance with the following Table:—

Length of Bulwarks in "Well," in feet.	Freeing Port Area on each side, in square feet.
30	9·5
35	10·0
40	10·5
45	11·0
50	11·5
55	12·0
60	12·5

65 and above, one square foot to each 5-ft. length of bulwarks.

WINDLASS AND HAWSE-PIPES.

Section 37. 1. The **windlass** is to be of suitable size for the cable, and to be efficiently secured.

2. The **hawse-pipes** must be of sufficient size and thickness, and the outside flange of proper form to admit of an easy lead for the cable to the windlass or capstan.

CHAIN PLATES.

Section 38. The **chain plates** to be in proportion to the size of the vessel, and riveted efficiently to the outside plating (not bulwark plating), the sheerstrake being preferable.

PUMPING ARRANGEMENTS.

Section 39. 1. In steam vessels the pumping arrangements according to the division of holds, &c., are to be as follows:—

2. **Holds with double bottoms.**—In the double bottom of each compartment of the holds and of the engine and boiler space, a steam pump suction is to be fitted at the middle line, and one on each side to clear the tanks of water when the vessel has a heavy list.

Where there is considerable rise of floor towards the ends of vessels, the middle line suction only will be required. A steam pump suction and a hand pump are also to be fitted to each bilge in each hold where there is no well.

Where there is a well, one or three steam pump suctions are to be fitted in the same according as there is considerable or little rise of floor, and hand pumps are to be fitted at the bilges.

3. **Holds without double bottoms.**—Where there is considerable rise of floor, one steam pump suction and one hand pump are to be fitted in each hold. Where there is little rise of floor, two or three steam pump suctions and at least one hand pump are to be fitted to each hold.

4. **Engine and boiler space.**—Where a double bottom extends the whole length of the engine and boiler space, two steam pump suctions are to be fitted to the bilge on each side. Where there is a well, one steam pump suction should be fitted in each bilge and one in the well. Where there is no double bottom in the machinery space, centre and wing steam pump suctions should be fitted.

The rose box, or strum, of the bilge injection is to be fitted where easily accessible. The main engine bilge pump and the donkey pump are to be arranged to draw from all compartments, and the donkey pump is to have also a separate bilge suction in the engine room, which can be used at the same time as the main engine bilge pumps are drawing from any other part of the vessel.

5. **Fore and After Peaks.**—If the peaks are fitted as water ballast tanks, a separate steam pump suction is to be led to each. If not used for water ballast, an efficient pump is to be fitted in the fore peak. If the after peak is used as a ballast tank, no sluice valve or cock is to be fitted to the after bulkhead; but if it is not so used, and if no pump is fitted in it, a sluice valve or cock is to be fitted to the after bulkhead, to allow water to reach the pumps when required.

6. **Tunnel.**—The tunnel well is to be fitted with a steam pump suction.

7. **All Hand Pumps** are to be capable of being worked from the upper or main decks or above the Load Water Line, the bottoms of the pump chambers are not to be more than 24 feet above the suction rose, and the pumps are to be

tested by the Surveyors to ensure that water can be pumped from the limbers. The sizes of the hand pumps are to be not less than those given in the following Table :—

Tonnage under Upper Deck.	Hand Pumps in Holds.	
	Diameter of Barrel.	Diameter of Tail Pipe.
	Inches.	Inches.
In vessels not exceeding 500 tons	4	2
Above 500 tons but not exceeding 1,000 „	$4\frac{1}{2}$	$2\frac{1}{4}$
„ 1,000 „ „ 2,000 „	5	$2\frac{1}{2}$
„ 2,000 tons	$5\frac{1}{2}$	$2\frac{3}{4}$

In lieu of hand pumps in each compartment, an approved **fly wheel pump** may be fitted if it is connected to the steam pump bilge suction pipes of these compartments.

The hand pumps may be dispensed with in vessels which have two independent boiler rooms, or a donkey boiler above the bulkhead deck, and steam pumps (workable from either source of steam) in two separate compartments, connected to the suctions.

8. **No Sluice Valve or Cock** is to be fitted to the collision bulkhead.

9. **No Sluice Valves or Cocks** are to be fitted to the engine room or other watertight bulkheads unless they are arranged so as to be at all times accessible.

10. **When Sluice Valves** are fitted, they are to be so arranged as to be controlled above the Load Water Line, and the rods are to be boxed in to prevent injury.

11. **Sounding Pipes** are to be fitted on each side of holds and ballast tanks, and a doubling plate is to be fitted under each.

12. **Air Pipes** are to be fitted to each ballast tank as required.

13. Where owners desire to fit non-return valves to bilge suction pipes in order to prevent the possibility of flooding after damage, such valves must be of an approved pattern. All other cocks and valves in connection with bilge and ballast suction pipes are to be fitted in places where they are at all times accessible.

14. All **Bilge Suction Pipes** are to be fitted with strum boxes or strainers, so constructed that they can be cleared without breaking the joints of the suction pipes. The total area of the perforations in the strainers should be not less than double that of the cross section of the suction pipe.

15. The **filling pipes for deep tanks** which can be used for either cargo or ballast must be controlled by valves placed in an accessible position, and so arranged that when the tank is being used for cargo it will be impossible to fill it with water. This result is to be obtained by taking out a short bend or wedge piece and fitting blank flanges in its place, or in some other way to be submitted to and approved by the Committee.

16. The **Pipes** for bilge or ballast suctions are to be fitted with flanged joints in convenient lengths, so that they may be easily disconnected for clearing. In the case of cast iron suction pipes, which are not also used as tank filling pipes, or which cannot be subjected to sea pressure, spigot and faucet joints made with india-rubber rings fitted over the spigots might be adopted, except in the case of bilge suction pipes passing through ballast tanks, which should be fitted with flanged joints.

17. The **Suction Pipes** to fore and after peaks, and to the tunnel well, should not be less than $2\frac{1}{4}$ inches inside diameter, except in vessels not exceeding 500 tons under deck, in which case they may be made 2 inches.

18. The **Bilge Injection** should not be less than two-thirds of the diameter of the sea inlet to the circulating pump.

19. The **inside diameter** of other **bilge suction pipes** should not be less than given in the following Table :—

Tonnage under Upper Deck.	Engine Room Centre Suction, Separate Donkey Suction, and Hold Centre Suctions.	Wing Suctions in Holds where no Centre Suctions are fitted, and Wing Suctions in Engine Room.	Wing Suctions in Holds where Centre Suctions are also fitted.
	Inches.	Inches.	Inches.
In vessels not exceeding 500 tons	2	2	2
Above 500 tons but not exceeding 1,000 „	$2\frac{1}{4}$	2	2
„ 1,000 „ „ 1,500 „	$2\frac{1}{2}$	$2\frac{1}{4}$	2
„ 1,500 „ „ 2,000 „	3	$2\frac{3}{4}$	$2\frac{1}{4}$
„ 2,000 „ „ 3,000 „	$3\frac{1}{2}$	3	$2\frac{1}{2}$
„ 3,000 tons	$3\frac{1}{2}$	$3\frac{1}{2}$	$2\frac{3}{4}$

In cases where more than one suction to any one compartment are connected to the pumps by a single pipe, this pipe should be not less than the size required for the centre suction.

COCKS, VALVES, AND SOIL PIPES.

Section 40. 1. All **head and stern pumps** if fitted are to be provided with sea-cocks fitted to the outside plating to the satisfaction of the Surveyors, and in places where they are at all times accessible.

2. **Storm Valves.**—Where **soil or scupper pipes** are attached to the outside plating below or near the Load Water Line, storm valves are to be fitted in substantial metal castings other than cast iron. The lower length of pipe should be of galvanized iron or steel of substantial thickness, not less than standard steam pipe quality and thickness, or if of lead it must be efficiently cased with zinc. Where passing through cargo or bunker spaces the pipes are to be protected by a substantial casing, but wood casing is not to be used in coal bunkers.

CEMENT.

Section 41. 1. The frames and plating of the bottom of all vessels to the upper parts of the bilges to be thickly and efficiently covered with Portland or other approved cement, which may be mixed with sand or other suitable substance. Care to be taken to have a proper thickness of cement at its termination, and to keep the watercourses clear all fore and aft. The whole to be to the satisfaction of the Surveyors.

2. Where **asphalt, enamel cement,** or similar compositions are to be used, the same must be sanctioned by the Owners, and samples are to be submitted for the approval of the Committee.

The condition of such compositions is to be ascertained by the Society's Surveyors biennially, and vessels coated with compositions as above described will be distinguished with a record of "Asp." in the Register Book.

CEILING.

Section 42. 1. **Close Ceiling.** All vessels to be closely ceiled from the main keelson to the upper part of the bilges, the ceiling to be secured in such a manner as to be easily removed.

2. The **ceiling on the floors** of vessels not having double bottoms should be made in hatches where practicable, of convenient sizes, and when not so arranged to be fastened to the reversed angle bars or frames in such a manner as to be removed when required for the purpose of survey, or for cleaning and painting.

3. The **ceiling on the double bottom** of a cargo hold may be omitted, except under the hatchways and over the limbers at the bilges. If the ceiling is omitted under hatchways the tank top plating is to be increased ·08 inch in thickness in way of the hatchways. Where the manhole covers in the double bottoms of cargo holds, or their fittings, project above the tank top, and the ceiling is omitted, they must be protected by fitting an angle coaming around each manhole with a hatch either of wood or of steel fitted therein. Where the plating is protected with wood ceiling it should be $2\frac{1}{2}$ inches thick and laid on battens $1\frac{1}{2}$ inches thick, to admit of drainage water passing to the wells, or the ceiling may be laid on the top of the inner bottom embedded in a substantial covering such as Stockholm tar and cement. The ceiling on double bottoms to be removed when the tanks are required by the Rules to be tested.

4. **Thickness.**—The wood ceiling is to be 2 inches thick in vessels having a longitudinal number not exceeding 5,200. In all larger vessels the ceiling is to be $2\frac{1}{2}$ inches in thickness.

5. **Cargo battens** to be fitted from the upper part of the bilges upwards, including the 'tween decks of all types of vessels, and in permanently enclosed spaces in bridges, poops and other deck erections. In spaces exclusively intended for carrying coal, cargo battens may be dispensed with.

6. **Vessels not fitted with cargo battens.**—In the cases of vessels not fitted with cargo battens, the certificate of classification will be endorsed "*Cargo battens not fitted*," and the same notation will be printed in the Register Book.

STEERING GEAR.

(See also Table 25.)

Section 43. 1. **Rudder Stops.**—Suitable stops for the rudder should be securely fastened to the deck in way of the tiller or quadrant tiller. Where a suitable brake is fitted to the tiller or quadrant tiller, or where the steering quadrant is geared direct on to the steam steering engine, the deck stops may be dispensed with. The stops of the steam steering engines should be fitted at a smaller angle of helm than the rudder stops, so as to prevent excessive strains consequent on a rudder being forced against its stops.

2. **Spare Tiller.**—Vessels which have not two independent steering gears are to have spare tiller and gear ready for use when required.

3. **Independent Means of Steering.**—Where combined hand and steam steering gear is adopted, and in which both gears depend upon the efficiency of a keyed quadrant or tiller, independent means of steering must be provided.

Steamers above 250 feet in length are to be fitted with two independent steering gears, one of which must be a steam or other mechanical steering gear, and it is recommended that the two controlling wheels of the mechanical gear should be placed one at the gear and the other one on the navigating bridge.

4. **Protection of Steering Gear.**—In steamers above 250 feet in length, not having full poops or awning or shelter decks, the after steering wheel and gear are to be protected by a substantially constructed iron or steel deck house or hood.

5. **Springs or buffers** are to be fitted to all steam steering gears of steamers.

6. **Steering Chains or Rods.**—The diameters of steering chains or rods are to be as given in **Table 25** for the various diameters of rudder heads and the corresponding radii of quadrant tillers. Where the radius of quadrant or length of tiller adopted differs from that given in the Table, the diameter of steering chain is to be calculated from the following formula :—

$$d = \cdot 38\sqrt{\frac{D^3}{R}}$$

where d = diameter of chain in inches ;

D = diameter of rudder head in inches according to Table for rudder heads.

R = radius of quadrant or length of tiller at the centre of the chain in inches.

7. **Leads of Steering Chains.**—Care should be taken that the leads of the steering chains are made as direct as possible, sharp nips or bends being avoided.

8. The diameters at the centre of the chain of leading block sheaves are not to be less than sixteen times that of the steering chains, and the pins of the sheaves are not to be less than twice the diameter of the chains.

AWNING OR SHELTER DECK VESSELS AND VESSELS WITH PART AWNING DECKS.

Section 44. *In vessels of this type with closed continuous superstructures.*

(*a*) *A topgallant forecastle is to be fitted, extending for about one-tenth of the length of the vessel, or additional sheer is to be provided ;*

(*b*) *The protection of deck openings, such as hatchways and machinery casings, and the protection at the after steering gear should be provided as required by the Rules for an upper deck ; and*

(*c*) *The scantlings of the beams, pillars, and girders of the upper deck below the shelter or awning deck, or of an upper deck below a superstructure, shall be determined in the same manner as for a cargo deck, except where such deck is used exclusively for passenger accommodation.*

1. In an awning or shelter deck vessel the transverse number is to be obtained from measurements taken to the deck next below the awning or shelter deck, provided the distance between these decks does not exceed 8 feet. Where the height of 'tween decks exceeds 8 feet the measurement is to be taken to a point 8 feet below the awning or shelter deck.

2. **Freeboard a condition of Class.**—It is a condition on which an awning or shelter deck, or part awning deck vessel is classed in the Society's Register Book that the freeboard assigned shall be marked on the vessel's sides as hereafter described.* The freeboard will also be inserted in the certificate of class and recorded in the Register Book. If the vessel proceed to sea with a less freeboard than that approved by the Committee, or if the freeboard mark be placed higher than the position assigned by the Committee, the vessel will be liable to have her class expunged from the Register Book.

3. **Forfeiture of Class.**—In all such cases, if the vessel has for any reason forfeited her class, the freeboard assigned as a condition of classification will be omitted in reprinting the Register Book, unless the class be previously reinstated.

4. **Notation in Register Book.**—Vessels to which this Section applies as regards an entire awning or shelter deck will be noted in the Register Book thus :—"Awng. dk." "Shelter dk." Those having a part awning deck will be noted "pt. Awng. dk."

5. **Deck Erections on Awning or Shelter Deck.**—When it is intended to fit erections on an awning or shelter deck, plans are to be submitted for the consideration of the Committee, showing the additional strengthening proposed to be fitted. Where a superstructure intended for passenger accommodation is to be built upon another superstructure, the deck beams above such accommodation are to be plated over in way of same. Plans of light superstructures

* See Notes of Freeboard requirements printed at end of Rules.

intended to be erected upon an upper, awning, shelter, or bridge deck are to be submitted for the approval of the Committee.

6. **Scantlings and Riveting.**—The scantlings of the awning or shelter deck plating, side plating and stringer plates are to be as required by **Table 18.** The attachments and riveting of the butts, edges, &c., of the awning or shelter deck stringer and plating, sheerstrake and side plating are to be as required by **Tables 19, 20,** and **21,** at an upper deck. The awning or shelter deck stringer angles are to be of the size given in **Table 18** for upper deck stringer angles.

7. **Framing.**—All the frames are to extend to the awning or shelter deck stringer plate, and they are to be of the sizes given in **Tables 2, 3, and 5,** but in no case are they to be less than $3\frac{1}{2}'' \times 3'' \times \cdot 30$ inch. The reverse frames are to extend to the height required by **Section 11.**

8. **Bulkheads and Casings.**—The collision bulkhead is in all cases to extend to the awning or shelter, or part-awning deck, the remaining bulkheads may stop at the deck next below, but a deep web frame or partial bulkhead is to be fitted on each side in the 'tween decks in continuation of each watertight bulkhead fitted below. Engine and boiler room hatchways on the deck next below awning or shelter, or part awning decks, to be enclosed by steel or iron trunk bulkheads efficiently strengthened, and extended from that deck to the awning or shelter or part-awning deck. (*See* **Section 31, paragraphs 1 and 2.**)

9. **"Upper" Deck.**—The deck below an awning or shelter deck, or part-awning deck, is to be laid and caulked.

10. **Deck Stringer to deck below awning or shelter deck.**—This deck stringer plate is to be fitted and connected to the outside plating by angle bars between the frames of the size given in **Table 17** for upper deck stringer angles in way of erections, and in addition, an inner stringer angle bar of the same size, passing continuously fore and aft, must be fitted inside the frames. The space between this angle bar and the outside plating all fore and aft, to be filled in and made watertight.

POOPS, BRIDGES, AND FORECASTLES.

Section 45. 1. **"Short" Deck Erections.**—In poops and forecastles, also in bridges not exceeding the lengths provided for in **Table 17,** the side plating, deck stringer plates and angles, tie plates and deck plating are to be of the scantlings required by that Table. The seams of the side plating may be single riveted except at the ends of the bridge, where they are to be double riveted for a length of about 20 feet. Where the bridge side plating is above ·48 inch in thickness the seams are to be double riveted throughout the bridge. The butts of the side plating should be not less than double riveted.

2. **"Long" Bridges.**—Where the length of bridge exceeds that provided for in **Table 17** the scantlings of the bridge side plating, deck plating and stringer plates and angles are to be as required by **Table 18.** The attachments and riveting of the butts, edges, &c., of the bridge deck stringer and plating, sheerstrake and side plating are to be as required by **Tables 19, 20,** and **21.** Where the seams of the side plating may not be required to be double riveted throughout, they must be double riveted for a length of about 20 feet at the ends of the bridge.

3. **Framing.**—All frames are to extend to the poop bridge, or forecastle stringer plate. Partial bulkheads are to be fitted in bridges in way of large deck houses, also in continuation of watertight bulkheads fitted below, and at such other places as may be considered necessary by the Surveyor.

4. **Reversed Frames in Forecastles.**—In top-gallant forecastles of vessels whose longitudinal number is above 14,000, the alternate reversed frames are to extend to the forecastle deck, or other efficient means of strengthening the forecastle may be adopted if approved by the Committee.

5. **Beams and Pillars.**—The poop, bridge, and forecastle beams are to be of the sizes given in **Table 12,** and placed at every alternate frame. Where an iron or steel bridge deck is fitted, the beams are to be of the sizes given in **Table 11,** and placed at every frame unless the iron or steel deck is sheathed with wood, in which case the beams may be placed at alternate frames, except in vessels over 450 feet in length, when the beams are to be fitted at every frame whether the plating is sheathed or not. (For diameter of pillars, *see* **Tables 14** and **15.**)

6. **Upper Deck Stringer Plate.**—The upper deck stringer plate in way of the deck erections is to be fitted and connected to the sheerstrake by angle bars between the frames, of the size given in **Table 17,** and in addition an inner stringer angle bar of the same size passing continuously fore and aft must be fitted inside the frames. The space between this angle bar and the sheerstrake to be filled in and made watertight.

7. **Wood Decks.**—The wood decks of these erections are to be as stated in **Section 26.**

8. **Strengthening at ends of Bridges and long Poops**—The upper deck sheerstrake is to be doubled its full breadth with plates not less than 20 feet in length and the stringer plate doubled or increased in thickness at the ends of a bridge. This additional strengthening is also required at the fore end of a poop or after end of a forecastle which exceeds one-fourth of the vessel's length. The bulwark plating at these parts is to be increased in thickness and supported by bracket plates; the freeing ports should have rounded corners and substantial rims, and the nearest stanchions to the ends of bridge or front of a long poop are not to be more than 5 feet from bridge or poop bulkhead and to be of additional strength, to the satisfaction of the Surveyors.

9. **Superstructures.**—Where a superstructure intended for passenger accommodation is to be built upon another superstructure, the deck beams above such accommodation are to be plated over in way of the same. Plans of light superstructures intended to be erected upon an upper, awning, shelter, or bridge deck are to be submitted for the approval of the Committee.

10. **Vessel's Proportions.**—All vessels having a length exceeding $13\frac{1}{2}$ depths to the upper deck are to have a bridge extending over the midship half length of the vessel or such special compensation for extreme proportions as may be required by the Committee.

11. **Poop and Bridge Bulkheads.**—Bulkheads at the fore end of all bridges and poops are to be of the thickness required for the side plating of short bridges, but need not exceed ·40 of an inch in thickness, with coaming plates ·04 of an inch thicker than the bulkheads. Those erections extending over the engine and boiler or other deck openings, are to have the bulkheads stiffened with bulb angles of the sizes stated in subjoined Table.

Breadth of Ship.	Size of Bulb Angle Stiffeners.	Breadth of Ship.	Size of Bulb Angle Stiffeners.
Feet.	Inches.	Feet.	Inches.
24	5 × 3 × ·40	46	$7\frac{1}{2} \times 3\frac{1}{2} \times ·56$
30	6 × 3 × ·44	50	$8 \times 3\frac{1}{2} \times ·64$
36	7 × 3 × ·50	54	$8\frac{1}{2} \times 3\frac{1}{2} \times ·64$
42	7 × 3 × ·56	58 and above	$9 \times 3\frac{1}{2} \times ·64$

The stiffeners are to be spaced 30 inches apart, and connected both to the coaming plates and to the deck plating, or to an athwartship plate on the beams both below and above, with a bracket plate to each end of the bulb stiffener. Bulkheads at the fore end of poops not extending over engine and boiler, or other deck openings, to be stiffened with plain angles of the size required for frames in the fore and after peaks, spaced 30 inches apart. The bulkheads at the ends of all poops, bridges, and forecastles are to be placed over a deck beam.

12. **Deck Erections on Small Vessels.**—Where it is proposed to fit a poop, bridge, or top-gallant forecastle to a vessel whose moulded depth does not exceed 15 feet, plans showing the proposed additional transverse strengthening are to be submitted for the consideration of the Committee.

RAISED QUARTER-DECKS.

(See also Sketches on page 174.)

Section 46. 1. **Framing and Side Stringers.**—The scantlings and arrangements of framing and side stringers in the way of a raised quarter-deck must be in accordance with the Rules for the increased depth of vessel, having regard to the position of the lowest tier of beams, as described in **Section 2, paragraph 4.**

2. **Side Plating and Deck Stringers.**—The scantlings of raised quarter-deck stringer, sheerstrake and strake below are to be as required by the Rules for a vessel of the depth and proportions to the raised quarter-deck.

3. **Beams.**—The size of beams of raised quarter-decks to be regulated as prescribed in **Tables 11, 12,** and **13.**

4. **Strengthening at Break.**—The upper deck sheerstrake is to be extended for a reasonable distance abaft the break and to be doubled or increased in thickness in way of the same; except in the case of a raised quarter-deck connected to a long bridge, when the raised quarter-deck sheerstrake is to be doubled or increased in thickness at the break. The bulwark plates of the raised quarter-deck adjoining the bridge side plating are to be increased in thickness and the upper deck sheerstrake is to be doubled at the front of the bridge.

5. **Butt Connections.**—The butts of the deck stringers and side plating throughout are to be arranged clear of each other and in way of the break the butts of the raised quarter-deck sheerstrake and two strakes of plating below the same are to be at least treble riveted. The upper deck stringer plate is to extend abaft the break about seven frame spaces, and the raised quarter-deck stringer plate about four frame spaces before the break, and the stringer plates below the upper deck are to have a shift of about 16 feet overlap; the bridge stringer also is to extend abaft the break.

6. **Break Bulkhead.**—The front or break bulkhead of the raised quarter-deck is to be of the thickness of the side

plating required by **Table 17** for short bridges. It is to be connected to the raised quarter-deck side plating by double angles, and is to be efficiently stiffened. An athwartship plate is also to be fitted, which will receive the deck ends, and be supported by bracket plates when it is not riveted to a beam. When the longitudinal number exceeds 15,000, or the vessel is over 13½ depths to length at upper deck, the break bulkhead is to be not less than four frame spaces abaft the after end of the engine room opening.

7. **Overlap of Decks.**—In vessels requiring by **Table 18** a steel deck or part steel deck, the upper deck plating is to scarph the raised quarter-deck for a length of two to three frame spaces, according to the size and proportions of the vessel, and the raised quarter-deck side plating is also to be doubled at this part for a length of from 18 feet to 20 feet. There are to be from four to five diaphragm plates fitted, of the thickness of the upper deck plating, connecting the two decks. They are to be attached to the decks and bulkhead by double angles, and stiffened by an angle on the after edges, also they are to be associated with web plates not less than 15 inches deep, fitted on the fore side of the bulkhead in the way of the same, and efficiently bracketed to the upper and bridge deck plating.

Where the longitudinal number is above 18,200 and does not exceed 19,500, the main and raised quarter-decks are to be scarphed four frame spaces, and where the longitudinal number is above 19,500, five frame spaces. The webs on the fore side of the break bulkhead are to be not less than 18 inches deep. In such vessels the raised quarter-deck side plating is to be doubled, commencing at one-fourth the length of the vessel from the stern and extending to 8 feet beyond the break of the raised quarter-deck.

Vessels which from their size and proportions do not require the decks to be scarphed, are to have from four to five bracket knees fitted on each side of the break bulkhead, the thickness of which is not to be less than that of the upper deck plating.

SAILING VESSELS.

Section 47.—The foregoing requirements for steamers are also applicable to sailing vessels except as regards the following particulars :—

1. All the **reversed frames** are to extend to the upper deck in sailing vessels having more than one tier of beams.

2. Sailing vessels above 20 ft. and not exceeding 33 ft. moulded depth are to have at least one tier of beams, spaced not more than two frame spaces apart, below the upper deck.

3. Sailing vessels above 22 ft. and not exceeding 27 ft. moulded depth are to have a **deep web frame**, of the breadth and thickness of the stringer plate at second deck, fitted in way of each mast and connected to the outside plating with double angles. These web frames are to extend to the upper deck stringer plate.

4. Where the moulded depth is above 27 ft. and does not exceed 33 ft., instead of the deep web frames prescribed in the preceding paragraph, **partial bulkheads**, as shown by the **Sketch** on page 175, are to be fitted in way of each mast.

5. Where a system of web frames as required by **Section 13** is adopted, the web frames are to extend in all cases to the upper deck. Where the moulded depth is above 22 ft. and does not exceed 27 ft., the web frames in way of the rigging of each mast are to be spaced not more than 4 frame spaces apart. Where, however, the moulded depth exceeds 27 feet, partial bulkheads are to be fitted as required by **paragraph 4** of this section, when the web frames in way of the rigging may be of the ordinary spacing.

6. **Panting Arrangements.**—The stringer plates on all tiers of panting beams are to be of the breadth and thickness required by **Table 17** for the second deck stringer plates at ends, and are to extend abaft the collision bulkhead for a length of not less than one-fourth the midship breadth of the vessel, attached to the outside plating and efficiently supported by brackets at alternate frames.

Sketches of panting arrangements are in all cases to be submitted for approval.

In sailing vessels above 20 ft. moulded depth panting beams and stringers are to be fitted at the after end.

7. Where the length of the midship beam does not exceed 30 feet, the upper and lower **deck beams** are to be ½ inch deeper than given in **Tables 11** and **12** for upper deck beams of the same length in steamers where one tier of beams only is fitted; and where the length is above 30 feet, the upper, lower and orlop deck beams are to be one inch deeper than given in the Tables. The depths of the beam knees are to be correspondingly increased.

8. Where plate knees are not fitted the beam knees are to be "turned."

9. **Outside Plating.**—The outside or overlapping strakes of plating for one quarter the length at the fore end should be reduced not more than ·06 of an inch from the midship thickness. Where the longitudinal number does not exceed 11,000 the sheerstrake is to be increased ·06 of an inch in thickness, and where the longitudinal number is above 11,000 it is to be increased ·10 of an inch in thickness, in each case for ¾ths the vessel's length amidships. In addition, when the longitudinal number is above 13,000, three strakes of plating at the bilges are to be increased ·06

of an inch in thickness throughout. When the longitudinal number is above 17,000, the strake of plating in way of the beams to second deck is to be increased ·06 of an inch in thickness for one-half the vessel's length amidships.

10. In sailing vessels only the foremost or **collision bulkhead** will be required, and it is to be placed at not less than one-half the vessel's midship breadth abaft the fore part of the stem at the lower deck.

11. **Diagonal tie plates** are to be fitted on the beams of all sailing vessels in way of the masts at the deck on which they are wedged; and, in addition, where the longitudinal number is above 11,000 diagonal tie plates are to be fitted all fore and aft on the upper deck. Where diagonal tie plates cross each other, or the fore and aft tie plates between the beams, and a deck is to be laid thereon, one set of tie plates must be set down in way of the crossing, so as to leave one thickness only projecting above the beams. The diagonal tie plates are to be of the width and thickness given in **Tables 17** and **18**. They are to be well riveted to each other and to the beams and stringers.

12. **Bulwark Stanchions.**—The stanchions which support the bulwarks are not to be more than 5 ft. apart. Where stanchions are fitted on the butt straps of the bulwark plating, the straps are to be sufficiently broad to receive the spur in the middle of the stanchion, and the bulwark plating is to be doubled or fitted with vertical straps in way of the intermediate stanchions. The heel of each stanchion is to be attached by not less than four $\frac{7}{8}$ in. bolts, tapped through the stringer plate and secured with a nut and grommet. Their size may be from $1\frac{3}{8}$ in. to 2 in. in diameter, regulated by the length of the stanchion and the size of the vessel. Other forms of stanchion may be adopted, provided they be submitted for approval.

13. The **mast rings** in sailing vessels are to be formed of bulb angle of the size required by the Tables for frames in fore and after peaks.

14. The **chain plates, rigging,** &c., are to be in accordance with the requirements of **Table 28.**

15. **Hand pumps** only are required to be fitted to sailing vessels, and they are not to be of less size than required by **Section 39, paragraph 7.**

VESSELS NOT BUILT UNDER SURVEY.

Section 48. 1. In cases of vessels not surveyed while building, for which a character may be required, application must be made to the Committee in writing, and such drawings, with scantlings of the vessel marked thereon, as may be obtainable, should be furnished, also particulars of the testing of the steel used in the construction of the vessel. The Committee will then direct a special examination to be made by two Surveyors of the Society (one of whom shall be an exclusive officer), for which purpose the vessel is to be placed on high blocks in a dry dock or on ways; the hold to be cleared and proper stages made; the rivets and plating of keel, and flat of bottom, thoroughly examined; the close ceiling in the hold to be removed where deemed necessary, but in no case less than required for **Special Survey No. 2.** The coal bunkers of steam vessels to be cleared; the whole of the frames, stringers, hooks, floor-plates, keelsons, engine and boiler bearers, ends of beams, water-tight bulkheads, rivets, and inner surface of the plating exposed to view; all oxidation to be removed by being cut or beaten off the several parts above named, also from the outside plating, rivets, keel, stem, stern-post, and rudder.

In cases where the inner surface of the bottom plating is coated with cement or asphalt, if the coating be carefully inspected, and tested by beating or chipping and found sound and adhering satisfactorily to the steel, its removal may be dispensed with, provided that upon the removal of a portion, the plating, frames, and rivets under it be found in satisfactory condition.

2. When the vessel is so prepared, the Surveyors are to ascertain the scantlings of the various parts, and verify the particulars given on the drawings furnished, drilling the shell plating where deemed necessary for this purpose. A few rivets are to be removed from various parts to ascertain their quality and the character of the countersinking and workmanship. A full report is to be made on a first entry report form for the information of the Committee, who will then assign the vessel such character as the facts may appear to them to warrant.

3. In addition to the above, if the age of the vessel be ten years or upwards, the requirements of the **Special Survey No. 3** are to be complied with. The periodical surveys are subsequently to be held as in the case of vessels built under survey.

4. In steam vessels the **Engines** and **Boilers** are to be opened out for Survey, at least to the extent required for the **Special Surveys Nos. 1, 2, and 3.** The Screw Shaft is to be drawn and examined. The arrangements of sea cocks, bilge suctions, valves, &c., are to be made to conform to the requirements of the Rules, and the working pressure of the boilers is to be determined from their actual scantlings in accordance with the Rules for the construction of boilers and particulars should be furnished respecting the testing of the steel.

RULES FOR THE BURNING AND CARRYING OF OIL FUEL.

Section 49. 1. In vessels fitted for burning oil fuel, and having the Society's classification, the following records will be made in the Register Book :—"Fitted for oil fuel F.P. above 150° F." in cases in which approval has been given for the use of oil with a flash point above 150° Fahrenheit; and "Fitted for low flash oil fuel" in cases in which the approval covers the use of oil with a lower flash point than 150° Fahrenheit.

2. The following arrangements are applicable only to the cases where the oil fuel to be used is such that its (close test) flash point, as determined by a recognised standard type of flash point apparatus, does not fall below 150° Fahrenheit.

For oil fuel with a lower flash point, the arrangements must be submitted for special consideration.

3. Oil fuel having a flash point above 150° Fahrenheit may be carried in ordinary cellular double bottoms, either under engines or boilers, or under ordinary cargo holds, also in peak tanks or in deep tanks or in oil bunkers specially constructed for the purpose.

4. Holes should not be cut in the centre girder, except in way of the narrow tanks at the ends of the vessel, and the centre girder need not be caulked or tested.

The lengths of the compartments are to be submitted for approval.

5. Peak tanks, deep tanks and bunkers specially constructed for oil fuel, and settling and other service tanks are to be fitted with bulkhead subdivisions or wash plates to the Committee's satisfaction and be strengthened so as to withstand efficiently the stresses brought upon them when only partly filled and in a seaway. The riveting of these spaces is to be as required by the Rules in the cases of vessels carrying petroleum in bulk and the scantlings and arrangements must be to the Committee's satisfaction.

6. Compartments for storing fresh water, either for use in boilers or for drinking, should be separated from oil fuel compartments by cofferdams to prevent the water from being contaminated, and pipes in connection with these compartments must be separate and distinct from any pipes which may be used for oil.

7. All double bottom compartments intended for carrying oil fuel must be tested by a head of water extending to the load waterline, or by a head sufficient to give the maximum pressure which can come upon them in practice, whichever is the greater.

All peak tanks, deep tanks, bunkers, settling tanks and service tanks specially constructed for carrying oil fuel are to be tested by a head of water equal to 30 per cent of the depth of the tank, or 8 feet, whichever is the greater, provided the tanks are fitted with overflows or other means to prevent a greater pressure than indicated above. Where the tanks are not fitted with overflows or other similar devices, they must be tested by a head sufficient to give the maximum pressure which can be experienced in practice. In all cases the pressure to which the tanks will be subjected is to be indicated on the plans submitted for approval.

8. Efficient means must be provided by wells or gutterways and sparring or lining, to prevent any leakage from any of the oil fuel compartments from coming into contact with cargo, and to ensure that any such leakage shall have free drainage into the limbers or wells. If cargo or coal is to be carried in a compartment adjacent to an oil fuel settling tank, which may be heated, the compartment side of the tank shall be insulated to prevent heating of the cargo or coal.

Where there is a possibility of oil leakage from bunkers, storage tanks, settling tanks, service tanks, pumps, heaters, and other apparatus, suitable gutterways, cofferdams, drip trays, or drip screens, are to be arranged, and provision to be made for draining same. Save-alls are to be fitted at the furnace mouths to intercept oil escaping from the burners.

9. If double bottoms under holds are used for carrying oil fuel, ceiling shall be laid on transverse battens, leaving at least two inches air space between the ceiling and tank top, and permitting free drainage from the tank top into the bilges or wells.

Where the ceiling is omitted, the thickness of the inner bottom plating may be as required by the Rules, with a minimum of ·40 inch, but the seams and butts are to be at least double riveted. In such cases it is recommended that owners should issue instructions to masters that efficient dunnage should be provided.

In all cases where oil fuel is carried in the double bottom under the engine and boiler spaces, the seams and butts of the tank top plating in way of those spaces are to be at least double riveted.

10. Each oil fuel compartment must be fitted with one or more air pipes, the discharge ends of which are to be led to the open air in a situation where no danger will be

incurred from the issuing oil vapour when the compartment is being filled, and each must be furnished with a wire gauze diaphragm which can readily be removed for cleaning or renewal.

When no overflow pipes are fitted, the sectional area of the air pipes to each compartment must not be less than that of its filling pipe.

If overflow pipes are fitted to any oil fuel compartments, they must have not less sectional area than the filling pipes, and must be so arranged that no oil or vapour issuing from them will be a source of danger.

11. Each oil fuel compartment is to be provided with a suitable means for ascertaining the oil level therein, either by sounding pipes or by approved indicating apparatus. If sounding pipes are fitted, they should be led to the weather deck or to an accessible position on a deck above the load line; short sounding pipes may be approved in the shaft tunnels or machinery spaces provided they are fitted to close automatically, or with lock-up screw caps of approved type. Doubling plates are to be fitted under all sounding pipes.

Round gauge glasses must not be fitted either to the oil storage, settling, or service tanks, but suitably protected gauges of approved design, having flat glasses of substantial thickness, and self-closing cocks or valves, may be allowed on settling and service tanks.

12. The boilers are to be suitably lagged. The clearance spaces between the boilers and tops of the double bottom tanks, and between the boilers and the sides of the storage tanks or bunkers in which oil fuel is carried must be adequate for the free circulation of air necessary to keep the temperature of the stored oil well below the flash point.

Where water tube boilers are installed, it is recommended that there should be a space of at least two feet six inches between the tank top and the underside of the pans forming the bottom of the combustion spaces.

Funnel dampers, if fitted, must be provided with a suitable device whereby they may be securely locked in the fully open position. On ships equipped for the use of oil fuel only, funnel dampers must not be fitted.

Smoke box doors must be shielded and well fitting, and the uptake joints made airtight.

13. The pressure pumps for the oil fuel burning system must be entirely separate from the feed, bilge, and ballast pumps and connections. In every ship there must be not fewer than two units (a unit comprising pressure pump, filters, and heater). All pumps used in connection with oil fuel are to be provided with efficient escape valves, which must be in close circuit, *i.e.*, discharging to the suction side of the pumps.

14. The oil pressure pipes must be of solid drawn steel, and those for conveying heated oil are to be placed in sight above the platforms in well-lighted parts of the stokehold or engine room. The coupling flanges must be machined so that they are practically metal to metal, any jointing material used being the very thinnest possible, and impervious to oil heated to 250° F. The scantlings of the flanges shall be made suitable for at least 200 lbs. per square inch working pressure, or the pressure to which the relief valves are loaded, whichever is the greater.

The pipes, heaters, and their fittings are to be tested after jointing to at least 400 lbs. per square inch, or to double the working pressure, whichever is the greater.

15. Other oil fuel pipes, and all bilge or water pipes passing through oil storage tanks are to be made of iron or steel. The coupling flanges must be machined and the jointing material used must be impervious to oil. The scantlings of the flanges are to be made suitable for not less than 100 lbs. per square inch working pressure, and, after jointing, the oil fuel pipes within the engine and boiler spaces are to be tested to 30 lbs. per square inch. All such pipes within the engine and boiler spaces must be led sufficiently high above the inner bottom to facilitate inspection and repairs.

16. All oil fuel suction pipes are to be fitted with valves or cocks at the bulkheads where they enter the machinery space.

In the case of all oil fuel storage, settling and daily service tanks, other than double bottom tanks, the suction valves or cocks are to be secured to the tanks, and so geared that they may be shut off from positions which will always be accessible in the event of fire taking place in the compartment in which they are situated. In the case of peak tanks, these valves, or cocks, are to be fitted on the tank side of the peak bulkheads.

All valves or cocks in the machinery space connected with oil fuel installations are to be capable of being controlled from above the engine and boiler room platforms.

If the filling pipes to settling and service tanks are not connected to the tanks near the top, they must be provided with valves or cocks, controlled as in the case of the suction valves or cocks on these tanks, or else with non-return valves, secured to the tanks.

Valves or cocks are to be interposed between the pumps and the suction pipes in order that the latter may be shut off when the pumps are opened out for overhauling.

All valves in connection with the oil fuel apparatus must be so constructed as to prevent the possibility of any cover being slacked back or loosened when operating the valves.

17. The motive power of all oil fuel pressure pumps, and the steam supply for the fire extinguishing apparatus, must be capable of being controlled from a position which will always be accessible in the event of fire taking place in the compartment in which they are situated as well as from the compartment itself.

18. Open drains for removing the water from the oil storage settling or service tanks are not allowed unless the drain cock, or drain valve, be of self-closing type.

19. If it is intended to carry sometimes oil fuel and sometimes water ballast in any of the compartments, the valves or cocks connecting the suction pipes of these compartments with the ballast donkey pump, and those connecting them with the oil fuel transfer pump, must be so arranged that the oil may be pumped from any one compartment by the oil fuel pump at the same time as the ballast donkey pump is being used on any other compartment.

If settling or service tanks are fitted of large capacity so that they do not require frequent replenishment, the above requirement may be dispensed with.

20. The pumping arrangements of the oil fuel installation must be submitted for approval.

21. In the case of deep tanks which can be used for oil fuel, water ballast, or cargo, provision is to be made for blank flanging the oil fuel and water ballast filling and suction pipes when the tanks are being used for cargo, and for blank flanging the bilge suction pipes when the tanks are being used for oil fuel or for water ballast.

22. The spaces in which the oil fuel burning appliances and the oil fuel settling and service tanks are fitted must be well ventilated and easy of access.

23. No wood fittings or bearers are to be fitted in the boiler rooms, or in the compartments containing the settling tanks.

Bilge suction pipes of lead are not permissible in engine or boiler spaces where settling tanks or oil fuel appliances are situated.

24. Water service pipes and hoses are to be fitted so that the stokehold plates and tank tops under the boilers can at any time be flushed with sea water, and in addition, steam from the auxiliary range of piping is to be led to pipes perforated for the emission of steam into the lower parts of the boiler room.

25. If steam is used for heating the oil fuel, either in the bunkers, tanks, or heaters, the exhaust drains must discharge the water of condensation into an observation tank where it can be seen whether or not it is free from oil.

The steam heating pipes in contact with the oil fuel are to be of wrought iron or steel, and are to be tested, after being fitted on board, to twice their working pressure.

EQUIPMENT.

Section 50. 1. All vessels having **masts, spars, rigging,** and **sails** shall be required to have them maintained in good order.

2. Every ship is to be provided with **anchors, cables, &c.,** of approved quality, tested at a *public machine* recognised by the Committee, in number and length as set forth in **Tables 30** and **31.**

3. To entitle vessels classed **A** "For Channel Purposes" to the Figure 1, the equipment of Anchors and Chain Cables, &c., should be as required by **Table 31,** with the exception that not more than two bower anchors and one stream anchor need be supplied. The first bower anchor should be of the full weight required by the Table, and the second bower may be 15 per cent. lighter. This rule, however, applies only to vessels intended for short passages.

4. In vessels classed "For Channel Purposes" which are intended for longer voyages, such as the Queenboro'-Flushing, the Channel Islands, or the Irish Sea service, the equipment must be in accordance with the requirements of **Table 31.**

5. In the case of **vessels of other than British Registry** classed with the Figure 1, in which the chains and anchors, or part of the same, have been tested under the inspection of the Society's Surveyors at Proving Establishments out of the United Kingdom recognised by the Committee, and test certificates of the same are furnished, duly signed by the Society's Surveyors, the vessel will have recorded in the Register Book the notation A.&C.P., A.P. or C.P. as the case may be. Where, however, the anchors or cable for **vessels of other than British Registry** are manufactured abroad and test certificates are furnished setting forth that they have been tested at a Government machine, or at a machine under the control of a municipal body or a similar responsible body, but not under the inspection of a Surveyor

to the Society, the record of A.&C.P., &c., will not be made in the Register Book, though such certificates will be accepted, as complying with the requirements of the Rules, for assigning the Figure 1, provided the remaining requirements of **Tables 30** and **31** be complied with.

6. **A certificate** of all chains and anchors having been tested, and of the strain applied to them, must be produced before the ship is classed with the Figure 1.

7. **Equipment Number.**—The equipment as regards anchors, chains, warps, &c., is to be regulated by the number produced by the sum of the measurements in feet of the greatest moulded breadth of the vessel and the depth from the upper part of the keel to the top of the upper deck beams at side at the middle of the length, multiplied by the length of the vessel. In vessels having cruiser sterns, the length for determining the Equipment number is to be measured as required by **Section 2** for vessels of this type. In awning or shelter deck or part awning deck vessels, the measurement of depth defined above is to be taken to the deck next below the awning or shelter deck, provided the height between the decks does not exceed 8 feet. If the 'tween deck height exceeds 8 feet the measurement is to be taken to a point 8 feet below the awning or shelter deck. In turret deck vessels it is to be taken to the normal beam line at base of turret.

For a vessel having **erections** on deck the number obtained by the previous paragraph is to be increased as follows :—

For a raised quarter deck, add the product of the height and length in feet of the erection.

For an awning or shelter deck, part awning deck, poop, bridge or forecastle, add three-fourths the product of the height and length in feet of such erections, 8 feet being taken as the maximum height for awning or shelter deck, or part awning deck erections.

For deck houses or other erections not extending to the side, but exceeding either in length or breadth half the rule breadth of the vessel, add one-half the product of the height and length of such erections.

Where erections are fitted upon erections the equipment number is to be correspondingly increased.

8. The equipment for **Sailing and Steam Trawlers and Tugs** is to be as given on back of **Tables 30** and **31.**

9. All vessels not exceeding 150 tons to be provided with one good boat; and every vessel above 150 tons to have a suitable number. The Surveyors are to be particular in examining and reporting the condition of the boats of all vessels.

10. **Anchor Cranes** and **Boats' Davits** to be in accordance with **Table 29.**

11. The efficient state and condition of the whole of a vessel's equipment will be designated by the Figure 1 placed after the character assigned to the vessel; and in cases in which the equipment is found insufficient in quantity or defective in quality, a dash thus —, will be inserted in place of the Figure 1. In cases where the Figure 1 is expunged on account of deficiencies in the anchors or chains, the record of Lloyd's A.&C.P. or A.&C.P. will also be expunged.

71, FENCHURCH STREET, LONDON, E.C.
9th December, 1920.

By order of the Committee,
ANDREW SCOTT,
Secretary.

RULES FOR THE CONSTRUCTION OF VESSELS INTENDED TO CARRY OIL IN BULK.

GENERAL.

Section 51. 1. The **scantlings, arrangements and equipment,** also the Rules for Special and other surveys and all requirements relating to vessels intended for the carriage of oil in bulk are to be as prescribed by the Society's "Rules for the construction of Steel Vessels," except where otherwise specified by the following Rules and Tables.

2. **Submission of Plans.**—In addition to the usual sketches of Midship Section, profile and deck plans, sketches are to be submitted showing the arrangement of oil tanks and cofferdams, the stiffening proposed for the transverse and longitudinal bulkheads, the construction of the tunnel and the bracket attachments at the ends of beams, stringers, webs, bulkhead stiffeners, &c.

3. **Length of Oil Compartments.**—The oil compartments are not to exceed from 24 feet to 28 feet in length.

4. **Expansion trunks** are to be fitted over the oil compartments of sufficient capacity to admit of the expansion or contraction of the oil due to changes of temperature. They are to be so arranged that the surface of the oil will not fall below the sides of the trunks when the vessel is rolling or pitching in a seaway. Where the breadth of the expansion trunk exceeds sixty per cent. of the breadth of the vessel, or the height of the trunk exceeds eight feet above the top of the oil compartments, the proposal must be specially submitted for the Committee's consideration, and if approved, the scantlings in way of the oil compartments must be increased, and any structural arrangements adopted as may be considered desirable.

5. **Cofferdams** are to be fitted at the fore and after ends of the space intended for the oil cargo, and where the machinery is fitted amidships cofferdams are also to be fitted at each end of the machinery space in order that the oil cargo may be isolated from the holds and from the engine and boiler spaces. The cofferdams are to be not less than two frame spaces in length and are to extend from the keel to the top of the continuous expansion trunk for the full breadth of the vessel.

6. The **number of watertight bulkheads** extending to the upper deck is to be as required by **Section 19.**

7. **Deck Erections.**—In vessels having the machinery aft, a poop must be fitted of sufficient length to cover the machinery space. Where the engines are fitted amidships, the bridge is to be of sufficient length to overlap the ends of the middle line bulkhead in the oil compartments.

8. **Cement.**—Portland Cement may be dispensed with in compartments intended for carrying oil in bulk.

9. **Testing.**—Each oil compartment is to be filled separately with water and tested by pressure before the vessel is launched, or while in dry dock. The pressure is to be obtained by means of a head of water eight feet above the highest point of the expansion trunk. Cofferdams are to be tested by being filled with water to the top of the hatchway.

10. **Electric light** is to be fitted in accordance with the Rules set forth on pages 107 to 120.

WORKMANSHIP.

Section 52. 1. Owing to the penetrating character of the oil and the stresses to which oil vessels are subjected, due to the cargo being carried directly upon the outside plating of the vessel, it is of primary importance that the **workmanship** throughout be **of the highest character.**

2. The **butts of plating** to be planed and fitted close; the **edges** of the plating to be sheared from the faying surfaces, or the "burr" caused by shearing to be carefully chipped off, and all outside edges of plating are to be either planed or chipped fair. The butts and edges to be carefully caulked.

3. The **riveting** is to be of the most efficient character and the points of the rivets left full or convex. Special care is to be taken in the punching and countersinking of the holes and the fitting together of the various parts. Where any unfairness exists in the holes they are to be rimered, not drifted, and larger rivets used in the rimered holes. The "burr" caused by punching, and all drillings and rimerings must be removed before the different parts are screwed together for riveting. Where the heads of the rivets are not laid up close to the plating or angle bars, or where rivets when tested are found unsatisfactory they are to be removed, not caulked. All oil-tight joints are to have the surfaces of steel plates fitted close to each other and caulked, without, as far as practicable, the use of canvas, &c.

4. In oil-tight work **all angles** are to be **welded at the corners** and neither mitred nor overlapped.

5. The **angles attaching bracket plates** to the bulkheads are to extend along the bulkhead six inches beyond the points of the bracket plates. The bracket plates and angles are to be kept sufficiently clear of the bulkhead boundary bars to admit of the latter being efficiently caulked.

6. Where the **boundary bars** of oil-tight bulkheads consist of double angles, both flanges of each bar are to be caulked.

FLAT KEEL AND VERTICAL KEEL PLATES.

Section 53. 1. **Flat plate keels** are to be of the dimensions given in **Table 17.** The **vertical keel plate** forming the lowest strake of the middle line bulkhead is to be of sufficient breadth to admit of the seam at upper edge being above the upper end of the brackets attaching the floor plates to the bulkhead, and its thickness is to be ·10 of an inch more than the thickness required by **Table 33** for floor plates.

2. **Keel Angles.**—The angles connecting the vertical keel plates to the flat keel plates, are to be of the dimensions given in **Table 34.**

FRAMES AND REVERSED FRAMES.

Section 54. 1. The dimensions and spacing of the **frames and reversed frames** are to be as given in **Table 32.**

2. **Bulb angle frames** will not be required to extend to the middle line, provided they be carried down round the bilge and be scarphed to angle frames fitted at the lower edges of the floor plates. The scarphs are to be in length not less than six times the depth of the bulb angle frames and the butts are to be shifted on adjacent floors not less than the length of the scarph. In these cases the angle frames are to be of the same thickness as the floors, and their flanges of the breadth required for the fore and aft flanges of frames by **Table 32.** The angle and bulb angle frames are to be fitted on opposite sides of the floor plates.

3. When bulb angle frames are extended to the middle line they are to have a lap of not less than $4\frac{1}{2}$ inches with the floor plates.

4. In all cases the frames are to be cut in way of the deck forming the top of the tanks.

5. The **frames in the 'tween decks** may be of angles ·06 of an inch thicker than required by **Table 32,** in which case the reversed frames may be dispensed with, and they must be bracketed to the tank deck stringer at heel and to the beams above.

6. The **brackets** at the heels of the 'tween deck frames are to be of the same thickness as the frames, and are to be attached to the tank deck by double or single angles as required by **Table 36** for the attachment of bulkheads to tank deck. The brackets are to measure along each edge not less than five times the depth of the standing flange of the frames to which they are to be double riveted.

7. **Web Frames in 'tween decks.**—Web frames or partial bulkheads of the dimensions given in **Table 32** are to be fitted in the 'tween decks in line with the bulkheads and web frames fitted below. They are to be stiffened at their inner edges by angle bars, or the plates may be flanged.

8. **Reversed Frames on Floors.**—A reversed frame is to be fitted at the upper edge of each floor plate, of the dimensions required for double angles at face of web frames by **Table 32.**

9. **Height of Reversed Frames.**—Where the intermediate frames are formed of frames and reversed frames riveted together, all reversed frames are to extend to the deck at the top of the oil compartments.

FLOOR PLATES.

Section 55. 1. The **floor plates** are to be of the dimensions given in **Table 33,** and are to extend in one length from the middle line bulkhead to the bilge.

2. **Height of Floor Ends.**—The floors may be either turned up at the bilge to a vertical height of not less than twice the midship depth of floor above top of keel throughout the oil compartments, or bracket plates of the thickness of the floors may be fitted at the bilge extending to the same height.

3. **Moulding of Floor Plate.**—The **brackets at bilge** are to be attached to the floor plates by means of a double riveted overlap not less in length inside the frame than the midship depth of floor; and the depth of the floor plate at three-fourths the half moulded breadth of vessel from middle line, or at the inner end of the bracket, is to be not less than three-fourths the depth of floor amidships. The upper edge of the floor is, however, at no part to fall below the level of the upper edge of the floor at middle line. The rivet attachment of the bracket to the frame bar is not to be less than that to the floor.

4. **Bracket plates** are to be fitted attaching the floor plates **to the middle line bulkhead.** They are to be of the thickness of the floors, and are to measure along each edge clear of the attachments not less than the midship depth of floor plate. The brackets are to be attached to the floors by

double riveted overlaps, and the floors and brackets are to be attached to the middle line bulkhead on one side by double attachment angles, and on the opposite side by double angles consisting of the vertical stiffener on middle line bulkhead and a short attachment angle extending from the keel to beyond the point of the bracket.

5. The floor brackets both at middle line and bilge are to be stiffened at their inner edges by angle bars, or the bracket plates may be flanged.

6. The **floor plates at the transverse bulkheads** are to be increased to twice the Table depth and their thickness is to be as required by **Table 33**, but in no case less than that of the bulkhead plating to which they are attached.

7. The **floor plates to which web frames** are attached are to be at no part less in depth than the depth of the web frames.

SIDE AND BILGE KEELSONS.

Section 56. 1. **Intercostal keelsons** are to be of the scantlings given in **Table 34**. The intercostal plates are to be closely fitted between the floor plates and attached to the outside plating by angles of the size required by **Table 32**, these angles are to be double for a length of three frame spaces on each side of the bulkheads.

2. **Number of Keelsons.**—Two intercostal keelsons are to be fitted on each side where the moulded breadth of vessel amidships does not exceed 50 feet, and three where the breadth is above 50 feet and does not exceed 64 feet. Where three keelsons are required each is to be fitted with a vertical plate of three-fourths the depth given in **Table 34**.

3. **Attachment of Keelsons to Bulkheads.**—The keelsons are to be cut at the transverse bulkheads, to which they are to be attached, by brackets of the thickness of the floor plates measuring not less than two frame spaces in length along each edge from the bulkhead and top of floor. They are to be connected to the bulkhead on one side by double attachment angles, and on the other side by the vertical stiffeners or webs on the bulkheads, with an additional attachment angle in the way of the brackets, *see* **Sketch** on page 180.

4. The keelson brackets are to be stiffened at their inner edges by angle bars, or the plates may be flanged.

5. Where it may be desired to modify the arrangements of floors and keelsons, alternative proposals are to be submitted for approval.

WEB FRAMES AND SIDE STRINGERS.

Section 57. 1. **Web frames** and **side stringers** are to be fitted throughout the oil compartments and machinery space, and are to be as given in **Table 32**. The web frames are to be spaced not more than four frame spaces apart, and the side stringers as required by the Table.

2. The web frames are to be attached to the floors by treble riveted overlaps, and their heads are to be attached to strong beams and brackets at the tank deck ; they are to be continuous from the floors to the top of the oil compartments, the stringers being fitted intercostally.

3. **Face angles** of the dimensions given in **Table 32** are to be fitted at the inner edges of the web frames and stringer plates. Those on the web frames are to extend along the upper edges of the floor plates to within the outer keelson. The face angles on the stringer plates are to be connected across the face of the webs by buttstraps of the dimensions given in **Table 32.**

4. **Attachments.**—The stringer plates are to be closely fitted between the web frames. The double angles connecting the stringers to the web frames, and the angles connecting the stringers and web frames to the outside plating, are to be of the size required by **Table 32**. Where the depth of web frames is above 24 inches, the web frames are to be attached to the outside plating by double angles, or by equivalent single angles double riveted. The stringer plates are to be attached to the outside plating by double angles for a length of three frame spaces on each side of the bulkheads.

5. **Brackets under stringers.**—Where the side stringers are above 16 inches in depth they are to be supported by bracket plates fitted midway between the web frames, efficiently riveted to the frames and connected to the stringer plates by single attachment angles.

6. **Brackets to bulkheads.**—The stringers are to be attached to the transverse bulkheads by large bracket knee plates of the thickness of the stringer plates, extending fore and aft for a distance of three frame spaces from the bulkhead, or inner edge of horizontal girder, and transversely for two frame spaces from the inner edge of the stringer plate. The brackets are to be attached to the stringer plates by double riveted overlaps and to the bulkheads, on one side by double attachment angles, and on the opposite side by a double riveted overlap to the horizontal stiffener on the bulkhead ; an additional attachment angle is to be fitted connecting the horizontal stiffener to the bulkhead in way of the brackets. (*See* **Sketch** on page 180.)

7. The brackets attaching the stringer plates to the bulkheads are to be stiffened at their inner edges by angle bars, or the bracket plates may be flanged.

TRANSVERSE BULKHEADS TO OIL COMPARTMENTS.

Section 58. 1. The transverse oil-tight bulkheads are to be of the **thickness** given in **Table 35**, and are to extend to the top of the expansion trunk.

2. **Boundary angles.**—The bulkheads are to be attached to the outside plating, to the tank deck and to the sides and top of the expansion trunk by angles of the dimensions given in **Table 36.**

3. **Bulkhead liners** are to be fitted to the outer strakes of outside plating of sufficient length to take one row of rivets clear of the bulkhead frames, these rivets are to be closely spaced to admit of the ends of the liners being efficiently caulked.

4. **Bulkhead stiffeners.**—The bulkheads are to be supported by means of vertical bulb angle stiffeners and web plates and horizontal girders, of the dimensions given in **Table 35.** (*See* also **Sketches** on page 178.)

5. The **vertical bulb angle stiffeners** are to be spaced as required by **Table 35,** and their ends are to be kept sufficiently clear of the bulkhead boundary angles to admit of these being caulked.

6. The heels of the stiffeners are to be attached to the outside plating by **bracket plates** two frame spaces in length, and of a height equal to once and a half the depth of the floors measured from the outside plating, the floor plate adjacent to the bulkhead being dispensed with to admit of the brackets being fitted as described. The brackets are to be attached to the floor plates and outside plating by single attachment angles, and are to be of the thickness required by **Table 33** for floor plates amidships. They are to be stiffened along their upper edges by angle bars, or the plates may be flanged.

7. The heads of the bulb angle stiffeners are to be attached to the under side of the tank deck plating, or to a shelf plate in way of expansion trunk by **bracket plates** one frame space in length and in depth.

8. Vertical **web plates** of the dimensions required by **Table 35** are to be fitted, extending from the keelson brackets to the tank deck, or top of the expansion trunk. Two web plates are to be fitted on each side of the middle line where the breadth does not exceed 50 feet, and three on each side where the breadth is above 50 feet and not exceeding 64 feet. The webs are to be attached to the bulkheads by single attachment angles. Double angles are to be fitted attaching the heads of the webs to the tank deck plating, or shelf plate. The heels of the webs are to be attached to the keelson brackets as shown by **Sketch** on page 178. The inner edges of the web plates are to be stiffened by angle bars or the plates may be flanged.

9. **Horizontal girders** in number and dimensions as given in **Table 35** are to be fitted in line with the side stringers and extending from the middle line bulkhead to the sides of the vessel. Where plate girders are fitted they are to be connected to the transverse bulkheads by single attachment angles. The ends of the girders are to be attached to the sides of the vessel by means of the side stringer brackets and to the middle line bulkhead by brackets of the thickness of the side stringer plates, extending fore and aft and athwartships for a distance of two frame spaces and arranged as shown in **Sketch** on page 180. The inner edges of the brackets are to be stiffened by angle bars, or the bracket plates may be flanged.

10. The vertical web plates and horizontal girders are to be supported by **brackets** to prevent them from tripping.

11. In the **expansion trunk** the transverse bulkhead is to be stiffened by vertical angles as required by **Table 35,** bracketed at head and heel.

12. It is recommended the bulkhead plating be fitted vertically with the edges of the plating between the vertical stiffeners.

COFFERDAMS.

Section 59. 1. The **cofferdam bulkheads** are to be of the same thickness, and are to be attached to the outside plating, decks, &c., as required for the transverse bulkheads to the oil compartments.

2. **Bulkhead stiffening.**—The bulkheads are to be stiffened by bulb angles of the same size and spacing as required for the bulkheads in the oil compartments. The two bulkheads forming a cofferdam are to be tied together at each of the vertical stiffeners by a series of plate stays efficiently riveted to the vertical stiffeners, and flanged on the upper and lower edges, as shown in **Sketches** on pages 176 and 177.

3. The **keelsons and side stringers** are to be continued in the cofferdams by plates of the same thickness as the floor plates and extending to the inner ends of the keelson and stringer brackets. The plates are to be connected to the outside plating by double angles, and to the cofferdam bulkheads by the vertical stiffeners and doubling angles, the inner edges of the plates are to be stiffened by angle bars, or the plates may be flanged.

4. The vertical **bulb angle stiffeners** are to be bracketed at their ends as required at the other transverse bulkheads. Where cofferdams do not exceed two frame spaces in length the **floor** in the cofferdam may be dispensed with provided the lower ends of the stiffeners be connected

by fore and aft plates of the depth and thickness of the floor plates amidships. The **beam** at the upper part of the cofferdam may also be dispensed with, provided the upper ends of the stiffeners be connected by fore and aft plates similar to those at the lower ends, but of three-fourths the depth. These connecting plates at the upper and lower ends of the stiffeners are to have angle bars on their inner edges or the plates may be flanged; they are to be connected to the deck and outside plating by single attachment angles.

MIDDLE LINE BULKHEAD.

Section 60. 1. Throughout the oil compartments and cofferdams a middle line bulkhead of the **thickness** required by **Table 35** is to be fitted extending from the keel to the top of the expansion trunk. This bulkhead is to be made oil-tight throughout the oil compartments to the top of the expansion trunk; this does not apply to pump room and cofferdams. Beyond the cofferdams arrangements are to be made to avoid an abrupt termination of the strength by the fitting of large webs, brackets, etc.

2. **Boundary Angles.**—The middle line and transverse bulkheads are to be attached to each other by double angles $3\frac{1}{2}'' \times 3\frac{1}{2}''$ for $\frac{3}{4}''$ rivets, and $4'' \times 4''$ for $\frac{7}{8}''$ rivets, and of the same thickness as required for the double frame angles at sides of vessel. The middle line bulkhead is to be attached to the plating at top of expansion trunk by double angles of the same size as those at the top of transverse bulkheads.

3. **Bulkhead stiffeners.** — The bulkhead is to be supported by means of vertical bulb angle stiffeners and web plates and horizontal girders, of the dimensions given in **Table 35.** (*See* also **Sketches** on page 179.)

4. The **Vertical bulb angle stiffeners** are to be spaced the same as the frames, and their lower ends are to be kept sufficiently clear of the keel angles to admit of these being caulked; they are to be attached to the floors and brackets by two rows of rivets. An additional attachment angle is to be fitted connecting the stiffener to the bulkhead in way of the floor plate and bracket. The stiffeners are to be attached at their heads to the bracket knees of beams crossing the expansion trunk at the tank deck, or be bracketed to a shelf plate fitted at the same height. Where a tunnel is fitted through the after oil compartments the vertical stiffeners are to be efficiently bracketed to the top of the tunnel.

5. Vertical **web plates** of the same thickness as the plating at lower part of bulkhead are to be fitted opposite the web frames at the sides of the vessel. Their depth at the heel is not to be less than that of the floors at middle line, and at the head not less than two-thirds that at the heel. The lower ends of the web plates are to be overlapped and double riveted to the floor plates and further attached by brackets of the same thickness and breadth as the web, double riveted to both the floor and the web. The inner edges of the brackets are to be stiffened by angle bars, or the plates may be flanged. The web plates are to be attached at the head, either by a double riveted lap and bracket to the strong beams crossing the trunk at the tank deck, or by double angles to a shelf plate fitted at the same height. The inner edges of the web plates are to be stiffened by angle bars, or the plates may be flanged. The webs are to be connected to the bulkheads by single attachment angles.

6. Where the vertical stiffeners and webs are fitted extending continuously from the keel to the top of the expansion trunk, the **shelf plate** at tank deck may be dispensed with on that side of the bulkhead.

7. **Horizontal girders** in number and dimensions as given in **Table 35** are to be fitted in line with the horizontal girders on the transverse bulkheads. Where plate girders are fitted they are to be attached to the middle line bulkheads by single attachment angles. The ends of the girders are to be attached to the transverse bulkheads by brackets of the thickness of the side stringer plates extending fore and aft and athwartships for a distance of two frame spaces as shown in **Sketch** on page 180. The brackets are to be connected to the girders on one side of the transverse bulkhead by double riveted overlaps, and on the opposite side to the bulkhead plating by double attachment angles, or large single angle double riveted. The inner edges of the brackets are to be stiffened by angle bars or the bracket plates may be flanged.

8. The vertical web plates and horizontal girders are to be supported by **brackets** to prevent them from tripping.

9. In the **expansion trunk** the middle line bulkhead is to be stiffened by vertical angles as required by **Table 35** spaced the same as the frames and bracketed at head and heel, and by web plates fitted in line with those below.

BEAMS.

Section 61. 1. The **deck beams** are to be fitted at every frame at tank deck and decks above, also at top of expansion trunk. Their scantlings are to be regulated by the requirements of **Table 11.**

2. "**Strong**" **beams** of the dimensions required by **Table 12** for "strong" hold beams, or equivalent thereto, are to be fitted at the heads of all web frames in the oil compartments extending from the middle line bulkhead to the sides of the vessel.

3. The strong beams are to be overlapped and well riveted to the web frames at the sides of the vessel, and the

two are to be additionally connected by **brackets** of the same thickness as the web frames, the inner edge of the brackets being stiffened by angle bars, or the plates may be flanged. The breadth and depth of these knees are to be equal to the depth of the web frame, and they are to be measured from the lower edge of the beam and the inner edge of the web frame. The knees are to be double riveted in each arm.

4. The strong beams are to be connected to the middle line bulkhead by **brackets** similar to those at the sides of the vessel. On the one side of the bulkhead the brackets are to be connected to the vertical web plates by double riveted overlaps, and on the opposite side to the bulkhead plating by double attachment angles, The inner edges of the brackets are to be stiffened by angle bars, or the bracket plates may be flanged.

5. Where it may be desired to dispense with any of the strong beams in way of the expansion trunk on account of their interfering with the arrangement of hatchways leading to the oil compartments, plans showing the arrangements proposed with a view to providing equivalent strength are to be submitted for approval.

6. **Shelf Plates.**—One beam on each side of the transverse bulkheads is to be extended to the middle line bulkhead and to be attached thereto in the same way as at the sides of the vessel. The spaces between the transverse bulkheads and these adjacent beams are to be plated over in the expansion trunk.

7. The remainder of the beams are to extend within the sides of the expansion trunk sufficiently to admit of their ends being connected to the vertical stiffeners on the sides of the trunk by means of **bracket plates** of a breadth and depth equal to three times the depth of the beam. Any other efficient arrangement for obtaining the attachment at this part may be submitted for approval.

8. The beams of **decks above the tank deck** are to be cut at the sides of the expansion trunk and connected to the same by bracket plates, of the dimensions of beam knee brackets, and single attachment angles.

9. The beams at the **top of expansion trunks** are to be of upper deck size, efficiently bracketed at their ends to the sides of the expansion trunk and middle line bulkhead with plates of the dimensions of beam knee brackets.

PILLARS.

Section 62. 1. **Quarter pillars** formed of double channel bars of the dimensions required by **Table 15** are to be fitted at each strong beam in the oil compartment. The quarter pillars are to be fitted practically in line with the sides of the continuous expansion trunk.

2. Where the **trunk is not continuous,** girders of the dimensions required by **Table 16** are to be fitted under the tank deck at the heads of the pillars. Intercostal girders are also to be fitted to the decks above.

3. The pillars are to be attached at their heads to the beams or girders by large **gusset plates**; the lower ends of the pillars are to extend down and be well riveted to the floor plates and further attached by transverse gusset plates, double riveted, to the upper edges of the floors. The gusset plates are to be of the same thickness as the floor plates, their depth three times and their breadth five times the breadth of the channel bars.

OUTSIDE PLATING.

Section 63. 1. The **thickness** of the outside plating is to be as required by **Tables 17** and **18.**

2. The **butts** of outside plating are, so far as practicable, to be kept clear of the frame spaces adjacent to the oil-tight bulkheads, and the plate edges are not to be joggled.

DECK PLATING AND STRINGERS.

Section 64. 1. The **decks** of vessels intended to carry oil in bulk are to be of steel of not less **thickness** than required by **Tables 17** and **18,** and in no case less than ·30 of an inch. The thickness of tank deck plating and top of expansion trunk is not to be less than required by the following Table :—

Longitudinal Number.					Minimum thickness.
					inches.
		Not exceeding		16,400	·30
Above	16,400	and ,,	,,	20,100	·32
,,	20,100	,,	,,	24,300	·34
,,	24,300	,,	,,	27,100	·36
,,	27,100	,,	,,	29,900	·38
,,	29,900	,,	,,	39,700	·40
,,	39,700	,,	,,	43,900	·42
,,	43,900	,,	,,	48,100	·44
,,	48,100	,,	,,	50,000	·46

2. The steel deck forming the top of the oil tanks is to be fitted continuously over the oil compartments and through the cofferdams.

3. The **stringer angles** at tank decks are to be of the dimensions given in **Table 36** for single frames to bulkheads, but in no case less than required by **Table 18.**

4. **Shelf plates,** one frame space in breadth and of the thickness of the tank deck plating, are to be fitted inside the expansion trunks along each side of the middle line and

transverse bulkheads at the height of the tank deck, and additional cross tie plating supported by beams is to be fitted to the satisfaction of the Committee. A single angle of the size required for lower deck stringer angles is to be fitted along the inner edges of the shelf plates on the middle line bulkhead or the plates may be flanged.

5. All **hatchways and deck openings** are to have rounded corners and the deck plating is to be increased in thickness in way of the openings.

EXPANSION TRUNKS.

Section 65. 1. The plating forming the sides of the **expansion trunks** is to be of the thickness required by **Table 36.** It is to be stiffened by vertical angles, spaced the same as the frames, fitted inside the trunk and bracketed to the beams at head and heel. Vertical web plates, flanged on the inner edges and attached to the trunk plating by single attachment angles, are to be fitted opposite the web frames at the sides of the vessel. The vertical stiffeners and web plates are to be of the dimensions given in **Table 36.**

2. The side plating of the trunks is to be attached to the tank deck plating by angles of the dimensions given in **Table 36** for single angles attaching bulkheads to tank deck. The trunk side plating is to be attached to the upper deck plating, or top of expansion trunk, by single attachment angles.

3. Where expansion trunks are continuous, the sides of the same are to be carried through all cofferdams except the forward one, and also through the after one when the engines are fitted amidships.

4. Where the expansion trunks are not continuous, the plating and stiffening of the ends of the **short trunks** are to be at the sides as required by **Table 36** and the corners of the trunks are to be of rounded form.

5. **Small hatchways** in the top of expansion trunks are to be fitted with hinged plate covers capable of being made oil tight. A 6 inch screw plug is to be fitted in the cover to each tank, also a gas cock to admit of the release of gas from the tanks without opening the covers.

6. Where **large cargo hatchways** are fitted in the top of expansion trunks, sketches of the oil tight covers proposed to be fitted, also of the arrangements of strong beams and cross tie plating at the tank deck in way of the hatchways, are to be submitted for approval.

SUMMER TANKS.

Section 66. In cases where "**summer tanks**" are fitted in the 'tween decks they are to be constructed and tested as required for the ordinary oil compartments and efficient arrangements are to be made for the expansion of the oil.

ENGINE AND BOILER SPACE.

Section 67. 1. The **scantlings** and **arrangements** of web frames and side stringers in the machinery space are to be similar to those in the oil compartments.

2. The **sides of continuous expansion trunks** are to be carried through the machinery space to form the casings of the engine and boiler openings; or to be efficiently overlapped with the same. The coaming plates of the casings are to extend below the deck at least twice the depth of the strong beams and to be fitted with double angles at the lower edge. They are to be incorporated with the deep web plates or large brackets at the bulkheads. The through beams in the machinery space are to be cut at the coamings and attached to the same by gusset plates and brackets.

3. Where a **double bottom** is fitted in the machinery space, care is to be taken to provide against an abrupt termination of the longitudinal strength at the bulkheads, by the fitting of webs, or large brackets, in way of the keelsons.

TUNNEL.

Section 68. 1. When engines are situated amidships, a **shaft tunnel** is to be fitted through the after oil compartments. It is to be entirely separated from the engine room by means of a cofferdam.

2. There is to be a **trunkway** at each end, leading from the upper deck to the tunnel, to afford means of readily entering and leaving the same. The trunkway at the forward end is to be abaft the cofferdam.

3. **Construction.**—The tunnel is to be circular in form and constructed of plating ·06 of an inch thicker than required by **Table 33** for floor plates amidships. It is to be attached to the middle line bulkhead above and below and to the transverse bulkheads by double angles of the size required for the angles attaching middle line and transverse bulkheads (**Section 60, paragraph 2**). A stiffening angle of the size required by **Table 36** for single frames to bulkheads is to be fitted round the outside of the tunnel in way of each web plate on middle line bulkhead. These angles are to be efficiently bracketed to the middle line bulkhead at upper part of tunnel and to the middle line bulkhead and floors at lower part. Efficient plate bearers are also to be fitted under the tunnel in way of the tunnel stools. Where horizontal girders on the transverse bulkheads are cut by the tunnel, their ends are to be connected to the tunnel plating by large plate brackets as to the middle line bulkhead.

RIVETING.

Section 69. 1. The **riveting** is to be of the most efficient character and the points of the rivets left full or convex. Special care is to be taken in the punching and countersinking of the holes and the fitting together of the various parts. Where any unfairness exists in the holes they are to be rimered, not drifted, and larger rivets used in the rimered holes. The "burr" caused by punching, and all drillings and rimerings must be removed before the different parts are screwed together for riveting. Where the heads of the rivets are not laid up close to the plating or angle bars, or where rivets when tested are found unsatisfactory they are to be removed, not caulked. All oil tight joints are to have the surfaces of steel plates fitted close to each other and caulked, without, as far as practicable, the use of canvas, &c.

2. The butts of **flat keel** plates are to be double strapped and treble riveted, the butts of the **vertical keel** plates over-lapped and treble riveted, and the flanges of the **flat keel angles** double reel riveted where six inches in breadth.

3. The seams and butts of the plating of the middle line and transverse **bulkheads** of the oil compartments, cofferdams and expansion trunks are to be double chain riveted; the flanges of single bulkhead frames are also to be double reel riveted.

4. The **seams of outside plating** in way of the oil compartments are not to be less than double chain riveted with an additional pair of rivets in each frame space beyond the number required by **Table 20.** In vessels above 450 feet and not exceeding 475 feet in length three seams of outside plating on each side between the bilge and tank deck are to be treble riveted between the peak bulkheads, in vessels above 475 feet and not exceeding 500 feet four seams, and in vessels above 500 feet and not exceeding 550 feet all the seams from the bilge to the tank deck are to be treble riveted.

5. The **butts of outside plating** in way of the oil compartments are not to be less than treble riveted and are to be either overlapped or double strapped. All vessels above 380 feet in length are to have double straps fitted to the butts of the sheerstrake. In vessels above 380 feet and not exceeding 400 feet in length double straps are to be fitted to the butts of the plating forming the flat of the bottom, in vessels above 400 feet and not exceeding 450 feet double straps are to be fitted to the butts of the bottom and bilge plating, and in vessels above 450 feet and not exceeding 550 feet in length double straps are to be fitted to the butts of all outside plating for three-fourths the vessel's length amidships. As an alternative arrangement to the double butt straps required above, quintuple riveted overlapped butts may be adopted, provided the butt attachments and riveting be in no case less than is required by **Table 21,** and the rivets be spaced as shown in paragraph 10 of this Section.

6. The **butts of the deck stringer plates** are to be not less than treble riveted and must be overlapped or double strapped. Where the stringer plates are ·60 of an inch and do not exceed ·70 of an inch in thickness, the butts are to be overlapped and quadruple riveted, and where the plates exceed ·70 of an inch in thickness, double straps are to be fitted to the butts or they may be overlapped and quintuple riveted, provided the butt attachments and riveting be in no case less than is required by **Table 21,** and the rivets be spaced as shown in paragraph 10 of this Section. The flanges of the tank deck stringer angles and the angles attaching the sides of the expansion trunk to the tank deck are to be double reel riveted.

7. The **seams and butts** of the **deck plating** forming the top of the oil compartments are not to be less than double chain riveted. When the deck plating is above ·48 of an inch in thickness the butts of the same are to be treble riveted.

8. The seams and butts of the plating forming sides and top of **expansion trunk** are to be not less than double chain riveted.

9. The seams and butts of **tunnel plating** are to be double chain riveted, and the flanges of the tunnel stiffeners are to be double riveted to the tunnel plating, web plates and brackets.

10. **Spacing of rivets.**—The rivets in the various parts are to be spaced as follows, viz.:—

3½ diam. C. to C.	In butts of flat and vertical keel plates, butts of outside plating and deck stringer plates, seams and butts of tank deck plating and middle line and transverse bulkheads, sides and top of expansion trunk and tunnel plating.
4 diam. C. to C.	In quadruple riveted overlapped butts of outside plating and deck stringer plates.
4½ diam. C. to C.	In quintuple riveted overlapped butts of outside plating and deck stringer plates.
5 diam. C. to C.	In flat keel angles, boundary bars of bulkheads, tank deck stringer angles and angles at upper and lower corners of expansion trunks, bracket knee plate attachments to floor plates, side stringers, and bulkhead stiffeners.

6 diam. C. to C.	In frames, reversed frames, floors, keelsons, face angles on web frames and side stringers, bulkhead stiffeners, web plates and girders, expansion trunk stiffeners, tunnel stiffeners and deck plating and top of expansion trunk to beams.

11. Wherever the frames, beams or stiffeners to bulkheads and expansion trunks cross the seams or butts of the plating, two rivets are to be fitted through the plating and bars.

12. **Attachment Angles.** The breadths of the flanges of attachment angles are to be as follows :—

for $\frac{5}{8}$ inch and $\frac{3}{4}$ inch rivets ...	3 inches.
for $\frac{7}{8}$ inch rivets...	$3\frac{1}{2}$ „
for 1 inch rivets...	4 „

the angles are to be of the mean thickness of the plates they attach.

PUMPING ARRANGEMENTS.

Section 70. 1. **Oil pumps** fitted for the purpose of filling or discharging the oil compartments are to be kept entirely separate from the pumps fitted for filling or clearing the water ballast compartments of water.

2. The **water ballast pipes** are not to pass through the oil compartments, nor the pipes for the oil through any water ballast spaces. A **separate ballast pump** is to be fitted forward of the oil compartments for the purpose of filling and clearing the forward ballast tanks.

3. Oil **pump rooms** are to be enclosed by watertight bulkheads and have no direct communication with the machinery space.

4. The **limber holes** in the floors and intercostals in the oil compartments are to be so arranged in the vicinity of the pumps as to admit of a sufficient flow of oil to the pump suctions.

5. Efficient arrangements are to be provided for clearing the **tunnel and 'tween deck spaces** of water.

6. **Sounding pipes** are to be fitted in the cofferdams.

VENTILATION.

Section 71. 1. It is of the greatest importance in oil carrying vessels that the internal arrangements should be such that the compartments can be readily cleared of gas, and efficient means are to be provided for **clearing the dangerous gases** from the tanks by the injection of steam or by the adoption of some efficient system of artificial ventilation.

2. **Ventilators** are to be fitted to the pump rooms cofferdams, 'tween decks, deck erections and other enclosed spaces, to allow of the free escape of all gases from these parts.

3. The **tunnel** is to be efficiently ventilated by large ventilators placed on the upper part of the trunks at the ends of the tunnel.

ELECTRIC LIGHTING.

Section 72. 1. The Electric Light Fittings are to be in accordance with the Rules set forth on pages 107 to 120.

PERIODICAL SURVEYS.

Section 73. 1. **Preparation of Tanks.**—When vessels classed for carrying oil in bulk are undergoing special survey, the tanks are to be cleaned out and thoroughly cleared of gas to admit of their being properly examined, and every precaution is to be taken to ensure safety during inspection.

2. **Testing.**—Each oil compartment and cofferdam is to be tested by being filled with water to the top of the hatchway in the expansion trunk or cofferdam.

By order of the Committee,

ANDREW SCOTT,
Secretary.

71, Fenchurch Street, London, E.C.,
22nd April, 1920.

TENTATIVE REGULATIONS FOR THE APPLICATION OF ELECTRIC ARC WELDING TO SHIP CONSTRUCTION.

GENERAL.

Section 74. The following Provisional Rules have been adopted as a tentative measure for the classification in Lloyd's Register Book of vessels electrically welded, subject to the notations "Experimental" and "Electrically welded."

The approval of the Society will be given to any system of welding which complies with these Regulations and consideration will be given to any alternative constructional arrangements which may be submitted for approval.

SYSTEM OF WELDING AND WORKMANSHIP.

Section 75. 1. The system of welding proposed to be used must be approved and must comply with the regulations and tests laid down by the Committee.

2. The process of manufacture of the electrodes must be such as to ensure reliability and uniformity in the finished article.

3. Specimens of the finished electrodes, together with specifications of the nature of the electrodes, must be supplied to the Committee for purposes of record.

4. The Society's Surveyors shall have access to the Works where the electrodes are manufactured, and will investigate, from time to time as may be necessary, the process of manufacture to ensure that the electrodes are identical with the approved specimens.

5. Alterations from the process approved for the manufacture of electrodes shall not be made without the consent of the Committee.

6. The regulations for the voltage and amperage to be used with each size of electrode, and for the size of electrode to be employed with different thicknesses of material to be joined, are to be approved by the Committee.

7. The Committee must be satisfied that the operators engaged are specially trained, and are experienced and efficient in the use of the welding system proposed to be employed.

8. Efficient supervisors of proved ability must be provided, and the proportion of supervisors to welders must be submitted for approval.

DETAILS OF CONSTRUCTION.

Section 76. 1. The details of construction of the vessel and of the welds are to be submitted for approval.

2. Before welding, the surfaces to be joined must be fitted close to each other and the methods to be adopted for this purpose are to be approved.

3. All butt and edge connections are to be lapped or strapped.

4. With lapped connections the breadths of overlaps of butts and seams and the profiles of the welds are to be in accordance with the following table :—

Thickness of plate. Inches.	Width of overlap seam and butt. Inches.	Throat thickness. Inches.
·40 and under	$2\frac{1}{4}$	·28
·60	$2\frac{1}{2}$	·38
·80	$2\frac{3}{4}$	·48
1·00	3	·50

Intermediate values may be obtained by direct interpolation, and for thicknesses below ·40 the throat thickness is to be about 70 per cent. of the thickness of the plate.

5. A "full weld" extends from the edge of a plate for a distance equal to the thickness of plate to be attached, and the minimum measurement from the inner edge of plate to the surface of weld is the throat thickness given in the table above.

6. A "light closing weld" is a single run of light welding worked continuously along the edge of the plate. Such a weld may, however, be interrupted where it crosses the connection of another member of the structure.

7. An "intermittent or tack weld" has short lengths of weld which are spaced three times the length of the weld from centre to centre of each short length of weld. Such tack welding may vary in amount of weld between a "full weld" and a "light closing weld."

8. The general character of welds is to be in accordance with the following table:—

	Inside edge.	Outside edge.
(*a*) Butts of shell, deck and inner bottom plating ...	F	F
(*b*) Butts of longitudinal girders and hatch coamings		
(*c*) Edges of shell, deck and inner bottom plating ...	L	F
(*d*) Butts and edges of bulkhead plating		
	Toe.	Heel.
(*e*) Frames to shell, reverse frames to frames and floors	T	L
(*f*) Beams to decks ...	T	L
(*g*) Longitudinal continuous angles		
(*h*) Side girders, bars to shell, intercostal plates, floors and inner bottom ...		
(*i*) Bulkhead stiffeners ...		

F = full weld, L = light weld, and T = tack weld.

9. All bars required to be watertight are to have continuous welding on both flanges with tack welding at heel of bar.

10. The welded connections of beam, frame and other brackets are to be submitted for special consideration.

11. The Committee may require, when considered necessary, additional attachment beyond that specified above, and the welding of all other parts is to be to their approval.

By order of the Committee,
ANDREW SCOTT,
Secretary.

71, Fenchurch Street, London, E.C. (3)
15*th August*, 1918.

The following firms having applied to have their systems of Electric Welding tested to ascertain whether they comply with the Tentative Regulations adopted by the Society, the applications have been complied with, and the Surveyors' reports found satisfactory by the Committee:—

The Alloy Welding Process, Ltd.	
The British Arc Welding Co., Ltd.	For work carried out by this Company.
The Quasi-Arc Co., Ltd.	
Elektriska Svetsnings Aktiebolaget (Kjellberg's Patents)	For work carried out by this Company.
The Anglo-Swedish Welding Co. (Kjellberg's Patents) ...	For work carried out by this Company.
Mitsu Bishi Zosen Kaisha (Kjellberg's Patents)	For work carried out by this Company.
Belgian-Swedish Electric Welding Co., Ltd. (Kjellberg's Patents)	For work carried out by this Company.

By order of the Committee,
ANDREW SCOTT,
Secretary.

71, Fenchurch Street, London, E.C. (3)
July, 1921.

RULES FOR THE SURVEY AND CONSTRUCTION OF ENGINES AND BOILERS OF STEAM VESSELS.

Section 1. In steam vessels, the machinery and boilers are to be inspected throughout, the boilers tested by hydraulic pressure, and the machinery tested under steam by the Society's Engineer-Surveyors, who will furnish a report to the Committee. If found satisfactory the Committee will thereupon grant a certificate, and insert in the Register Book the notification, "LMC" *in red* (*i.e.* "LLOYD'S MACHINERY CERTIFICATE"), indicating that the machinery and boilers are certified to be in good order and safe working condition.

Section 2. 1. In steam vessels built under Special Survey, the Machinery and Boilers must also be constructed under Special Survey.

2. In cases of machinery or new boilers being built under Special Survey, the distinguishing mark ✠ will be noted in red, thus: "✠LMC," or "✠NE & B," or "✠NB."

3. In order to facilitate this inspection, the plans of the machinery and boilers are to be examined, and from them the working pressure fixed.

4. Any novelty in the construction of the machinery or boilers is to be reported to the Committee.

5. The Surveyors are to examine the materials and workmanship from the commencement of the work until the final test of the machinery under steam; any defects, &c., to be pointed out as early as possible.

6. The Surveyors may also, if desired, compare the work as it progresses with the requirements of the specification agreed upon by the parties concerned, and certify to the conditions thereof, as far as can be seen, being satisfactorily complied with.

7. The machinery and boilers are to be securely fixed to the vessel to the satisfaction of the Surveyor.

Section 3. 1. All steam vessels must have at least two entirely separate means of supplying the main boilers with feed water, when working at full power.

2. If the main feed supply is from pumps worked from the main engines, then with engines above 70NHP, there must be two main feed pumps, so arranged that either can be shut off and overhauled while the other is at work. Each pump is to be capable of performing the whole work required.

3. In engines of 70NHP and under, and also in all engines of steam fishing vessels and of tugs and tenders, one main feed pump worked from the main engines will be approved, provided the auxiliary feed pump required by clause 5 is fitted.

4. The main feed pumps may be worked by independent engines provided they are fitted with automatic regulators for controlling their speed. If only one such pump is fitted for the main feed the auxiliary feed pump required by clause 5 should also be fitted with an automatic speed regulator.

5. A steam pump is to be provided as an auxiliary feed supply, capable of performing the whole work required of feeding the boilers at full power. This pump is to have suctions to the hotwell and to the sea. This pump may be also used for general purposes, but in this case the suction pipes to the hotwell and sea must be entirely distinct from those to the bilges.

Section 4. 1. The engines are to be fitted with two bilge pumps so arranged that one can be overhauled whilst the other is at work.

2. In engines of 70NHP and under and also in engines of steam fishing vessels, and of tugs and tenders, one bilge pump worked from the main engine will be sufficient, provided the steam pump required by clause 4 is fitted.

3. In lieu of bilge pumps worked from the main engines, a separate steam pump may be fitted additional to that required by clause 4.

4. A steam pump is to be provided connected to the main bilge system as required in clause 5.

5. The bilge pumps referred to in clauses 1, 2, 3 and 4 are to be arranged to pump from each compartment of the

vessel except the peaks, and to deliver overboard. At least one of the steam pumps (clauses 3, 4) is to be fitted with a direct suction to the engine room, which can be used while the other bilge pumps are being used on other parts of the vessel (*see* Section 39, clause 4, page 54). All bilge suction pipes are to be fitted with strum boxes or strainers, so constructed that they can be cleared without breaking the joints of the suction pipes. The total area of the perforations in the strainers should be not less than double that of the cross section of the suction pipe. The mud boxes and roses in engine room are to be placed where they are easily accessible, and to the satisfaction of the Surveyor.

6. A bilge suction to the circulating pump is to be fitted.

7. One of the steam pumps referred to in clauses 3 and 4 must be fitted to draw from the sea and to deliver water on deck.

Section 5. In vessels fitted with twin screw engines, the main feed pumps and the main engine bilge pumps may be fitted, one of each on each engine, provided they are so connected that either feed pump can deal with the water from both hotwells, and that either bilge pump can draw from all parts of the vessel.

Section 6. 1. All discharge pipes are to have discharge valves, which are to be fitted on the plating of the vessel in accessible positions.

2. No pipes are to be carried through the bunkers without being properly protected.

Section 7. 1. In all steam pipes provision is to be made for expansion and contraction to take place without unduly straining the pipes. Where the provision for expansion is by means of bends in the pipes it is recommended that the various lengths of pipes should be made short of the designed lengths by amounts equal to half the calculated expansion at the temperature of the steam.

2. For the thicknesses and tests of copper, iron, or steel steam and other pipes see Section 13.

Section 8. In single screw vessels fitted with steam turbine engines arrangements shall be made so that steam can be led direct to the L.P. Turbine and either the H.P. or I.P. Turbine can exhaust direct to the condenser. Two turbines are to be fitted with astern wheels.

Section 9. In all vessels fitted with steam engines in which the lubricating oil is circulated under pressure, a spare oil pump is to be supplied with all connections ready for immediate use, and two independent means are to be arranged for circulating water through the oil cooler.

COCKS, PIPES, SEA CONNECTIONS AND PUMPING ARRANGEMENTS.

Section 10. 1. All sea cocks and valves required to be fitted on the plating of the vessel are to be fixed in easily accessible places above the level of the stokehold and engine room platforms, or are to be fitted on strong iron or steel stands of a height sufficient to lift them up to the level of these platforms.

2. The bolts securing all cocks or sea connections to the plating of the vessel are to be tapped into the plating of the vessel or fitted with countersunk heads.

3. The blow-off cocks on the plating of the vessel are to be fitted with spigots passing through the plating, and a brass or gun-metal ring on the outside. The cocks are to be so constructed that the key or spanner can only be taken off when the cock is shut. (*See* Section 19, clause 3.)

4. Cocks and valves connecting all bilge suction pipes are to be fixed in accessible places above the stokehold and engine room platforms.

5. The arrangements of pumps, bilge suction and delivery pipes are to be such as will not permit of water being run from the sea into the vessel by an act of carelessness or neglect.

SHAFTS.

Section 11. 1. All shafts are to be turned all over and are to be examined when rough turned and when finished. In the case of screw shafts scrap steel is not to be used, and in no case is a mixture of scrap iron and scrap steel to be employed. It is recommended that screw shafts be made of ingot steel or forged from blooms made from rolled iron bar of good fibrous quality.

2. Gauges of an approved description for testing the truth of the crank shafts of Reciprocating Engines are to be supplied with all new engines, and adjusted in the presence of the Surveyor. Where Steam Turbine Engines are fitted, gauges for testing the truth of the rotor, pinion and gear wheel shafts are to be supplied, and adjusted in the presence of the Surveyor.

3. The length of the stern bush is to be at least four diameters of the shaft. It is recommended that the shaft liner should be continuous the whole length of the stern tube, and that the after end should be tapered in thickness and made watertight in the propeller boss. If the liner is made in two pieces the joint should be burned. If the liner does not fit tightly at the part between the bearings in the stern tube, the space between the shaft and the liner should

be charged or "forced" with a plastic material insoluble in water and non-corrosive. If two liners are used, it is recommended that they be tapered in thickness at the ends, and that the shaft should be lapped or protected between the liners. In this case, and also if no liners are used, the diameter of the shaft should be $\frac{21}{20}$ths of that required for a shaft with a continuous liner.

4. For dimensions of shafts, see the formulæ in Section 12.

RULES FOR DETERMINING SIZES OF SHAFTS.

Section 12. 1. The diameters of intermediate shafts are to be not less than those given by the following formulæ :—

For Compound Engines with two cranks at right angles—

Diameter of intermediate shaft in inches =

$$(\cdot 04\,A + \cdot 006\,D + \cdot 02\,S) \times \sqrt[3]{P}$$

For Triple expansion engines with three cranks at equal angles—

Diameter of intermediate shaft in inches=

$$(\cdot 038\,A + \cdot 009\,B + \cdot 002\,D + \cdot 0165\,S) \times \sqrt[3]{P}$$

For Quadruple expansion engines with two cranks at right angles—

Diameter of intermediate shaft in inches=

$$(\cdot 034\,A + \cdot 011\,B + \cdot 004\,C + \cdot 0014\,D + \cdot 016\,S) \times \sqrt[3]{P}$$

For Quadruple expansion engines with three cranks—

Diameter of intermediate shaft in inches=

$$(\cdot 028\,A + \cdot 014\,B + \cdot 006\,C + \cdot 0017\,D + \cdot 015\,S) \times \sqrt[3]{P}$$

For Quadruple expansion engines with four cranks—

Diameter of intermediate shaft in inches=

$$(\cdot 033\,A + \cdot 01\,B + \cdot 004\,C + \cdot 0013\,D + \cdot 0155\,S) \times \sqrt[3]{P}$$

where A = diameter of High Pressure Cylinder in inches,

B = diameter of first Intermediate Cylinder in inches,

C = diameter of second Intermediate Cylinder in inches,

D = diameter of Low Pressure Cylinder in inches,

S = Stroke of Pistons in inches,

P = Boiler pressure above atmosphere in lbs. per square inch.

2. The diameter of crank shaft, and of thrust shaft under the collars, to be at least $\frac{21}{20}$ths of that of the intermediate shaft. The diameter of thrust shaft may be tapered off at each end to the same size as that of the intermediate shaft.

3. For direct coupled and for geared steam turbine engines the

Diameter of the intermediate shaft in inches $= \sqrt[3]{\frac{64 \times SHP}{R}}$

where SHP is the shaft horse power at full power,

R is the number of revolutions of the shaft per minute at full power.

The diameter of the thrust shaft under the collars is to be at least $\frac{21}{20}$ths of that of the intermediate shaft.

4. The diameter of the screw shaft to be equal to the diameter of intermediate shaft (found as above) multiplied by $\left(\cdot 63 + \frac{\cdot 03\,P}{T}\right)$, but in no case to be less than $1 \cdot 07\,T$, where P is the diameter of propeller, and

T the diameter of intermediate shaft, both in inches.

This size of screw shaft is intended to apply to shafts fitted with continuous liners the whole length of the stern tube, as provided for in Section 11, paragraph 3. If no liners are used or if two separate liners are used, the diameter of the shaft should be $\frac{21}{20}$ths that given above.

The diameter of screw shaft is to be tapered off at the forward end to the size of the crank shaft.

5. NOTE.—The Rules are intended to apply to Two Cylinder Compound Engines, in which the ratio of areas of Low and High Pressure Cylinders does not exceed 4·5 to 1 ; to Triple Expansion Engines in which it does not exceed 9 to 1 ; to Quadruple Expansion Engines in which it does not exceed 12 to 1 ; and in all cases, as regards the stroke, in which the length of stroke is not less than one half the diameter or greater than the diameter of the Low Pressure Cylinder. Engines of extreme proportions beyond these limits being specially submitted to be dealt with on their merits.

STEAM AND OTHER PIPES.

Section 13. 1. No pipe made from the electro deposition of copper on a mandril shall be used for steam, feed delivery, blow-off or scum.

2. All copper steam, feed, blow-off and scum pipes must be properly annealed before fixing in place.

3. All copper pipes used for steam, feed, blow off and scum purposes subject to a pressure over 75 lbs. per square inch shall be solid drawn.

4. No steam pipe intended for a working pressure over 180lbs per square inch shall be of copper when the internal diameter exceeds 5 inches. No copper pipe shall be used for superheated steam.

5. All copper steam pipes on completion and prior to being fitted in place shall be subjected to an hydraulic test of at least twice the working pressure to which they will be subjected.

6. All copper feed delivery pipes shall be hydraulically tested to at least $2\frac{1}{2}$ times the working pressure of the boilers.

7. The working pressure to be allowed on copper pipes is to be determined by the following formula :—

$$WP = \frac{(t - 3) \times F}{D}$$

Where **WP** is the working pressure in lbs. per square inch,

D is the internal diameter in inches,

t is the thickness in 100ths of an inch,

F for solid drawn steam pipes is 60,
for solid drawn feed pipes is 48,
for brazed steam pipes 45,
for brazed feed pipes 36.

8. When copper pipes are bent they must be made thicker than required by clause 7 to provide for the thinning at the bend. In no case should the radius of curvature at the centre line of the pipe be less than twice the external diameter of the pipe.

9. Steam and other pipes may be made of wrought iron or of wrought steel.

10. The process of welding the seams of iron or steel pipes shall be such that it is done by hammering or rolling the joint.

11. On completion of any work on iron or steel steam pipes which involves heating whether for welding the joint, welding on flanges, bending the pipe or for any other purposes the pipe should be carefully annealed.

12. Mild steel for lap-welded or riveted steam pipes may have a tensile strength not exceeding 28 tons per square inch, with a minimum elongation of 25 per cent. on a Standard test piece with a gauge length of 8 inches.

13. Feed pipes if made of steel should be solid drawn, cold finished.

14. All iron or steel steam pipes prior to being fitted in place shall be subjected to an hydraulic test of at least three times the working pressure to which they will be subjected.

15. All iron or steel feed delivery pipes shall be hydraulically tested to at least four times the working pressure of the boilers.

16. The working pressure to be allowed upon iron or steel steam and feed pipes shall be determined from the following formulæ :—

a. For solid drawn cold finished steel steam pipes,

$$WP = \frac{(t - 10)}{D} \times 120$$

b. For solid drawn hot finished steel steam pipes,

$$WP = \frac{(t - 12)}{D} \times 120$$

c. For lap-welded steam pipes of iron or steel whether with or without covering straps,

$$WP = \frac{(t - 12)}{D} \times 90$$

d. For feed delivery pipes,

$$WP = \frac{(t - 8)}{D} \times 100$$

Where **WP** is the working pressure to which the steam pipes will be subjected, and in the case of feed delivery pipes is the boiler pressure,

D is the internal diameter of the pipes in inches ;

t is the thickness in 100ths of an inch.

BOILERS.

Section 14. 1. In the design and construction of Marine Boilers the following conditions should be observed :—

2. All steel plates, rivets, and bars used in the construction of boilers must be tested and found to conform to the requirements of the Rules. (Sections 33, 34.)

3. No steel plates subject to a direct tensile stress are to be welded except where the weld is covered by a butt strap or straps. For small steam domes, by special permission, where the welding is done by hammer, and the plates do not exceed $\frac{1}{2}$ inch in thickness, the straps may be omitted. The strength shall in such cases be assumed to be 50 per cent. of that of the solid plate.

4. All steel plates which are welded, dished, flanged, or locally heated are to be afterwards efficiently annealed.

5. Butt straps must be cut from plates and not from rolled strips.

6. All rivet holes must be drilled, and as far as possible they should be drilled in place. After drilling the plates the burrs should be removed and the faying surfaces of the plates cleaned, and the sharp outer edges of holes removed also.

7. No steel stays are to be welded. If plus threads are desired, the ends of the stay bars may be upset or the bars may be drawn down in the central portions from bars originally of the size of the ends. In either of these two cases the bars must be subsequently annealed throughout. In double ended boilers the through longitudinal stays must be supported at or near the middle of their length.

8. Screw stays of combustion chambers when fitted with nuts should be, as far as possible, normal to the chamber plates. When this is not possible they must be fitted with taper washers to provide a fair bed for the nuts.

9. Nuts to screw stays in combustion chambers shall be not less than $\frac{3}{4}$ inch thick for stays up to $1\frac{1}{2}$ inches diameter over threads, $\frac{7}{8}$ inch thick for $1\frac{5}{8}$ and $1\frac{3}{4}$ inch stays, 1 inch thick for $1\frac{7}{8}$ and 2 inch stays, and $1\frac{1}{8}$ inches thick for stays over 2 inches in diameter. The nuts shall be made of solid mild steel or of iron which must be without weld. The nuts for longitudinal stays shall be to the British standards appropriate to the diameters of the stays, the outside nuts having the thickness therein provided for ordinary nuts, and the inside nuts having the thickness provided for lock nuts.

10. All longitudinal stays and screw stays should have threads in accordance with British standard specification, and true to pitch, viz. :—

After June 30th, 1921, all screw stays $1\frac{1}{4}$ inches in diameter and upwards should have 9 threads per inch, and all stays 2 inches in diameter and above passing through plates, and secured by nuts on each side of the plate, should have not more than 6 threads per inch.

It is desirable for the threads of all screw stays to be turned off between the parts fitting into the plates. It is also desirable that the outer ends of screw stays should have a hole $\frac{3}{16}$ inch diameter drilled axially to a distance $\frac{1}{2}$ inch beyond the inner face of shell and end plates.

11. When jointed longitudinal stays are fitted between the front and back tube plates it is desirable that they should be fitted with pins having an effective sectional area 25 per cent. in excess of that of the stay. The pins may be slack in the holes, the total slackness being not more than $\frac{1}{16}$ inch. The pins must be as close as possible to the shoulder of the eye forging. The shoulder of the forging should have a diameter not less than 1 inch greater than the diameter of the hole.

Section 15. 1. No boiler, whether main or auxiliary, in which fuel oil only is used shall have a damper, or other possible means of obstruction to draught, in the uptake or funnel.

If the boilers are to use coal and oil fuel alternately, the uptake or funnel dampers, if fitted, must be provided with a suitable device whereby they may be securely locked in the fully open position.

2. Manholes in cylindrical shells must have their shorter axes arranged longitudinally. Where the cylindrical shell is cut for a manhole, compensation must be provided and must be such that the strength in way of the hole is not less than that required for the longitudinal joint.

3. The end plates in the steam space in way of uptakes are to be shielded from contact with the heated gases.

Section 16. 1. When a flat plate is flanged to stiffen it at a manhole or sight hole, to permit the same working pressure as would be allowed upon an unpierced plate the depth of the flange measured from the outer surface is to be at least

$$\text{equal to } \sqrt{t \times w}$$

where t is the thickness of the plate in inches and w is the minor axis of the hole in inches.

2. The doors to manholes, mudholes, and sightholes must be built up or pressed to shape and annealed, or made from one thickness of plate with a machined recess for the jointing material. Their spigot part or the recess must not have a greater clearance than $\frac{1}{16}$ inch all round, *i.e.*, the axes must not be less than $\frac{1}{8}$ inch smaller than the holes in which they are fitted.

3. The studs for securing all doors should be screwed through the plate, and be fitted with nuts on the inside or bolts may be used screwed through the plate with the heads inside.

4. All boilers should have, when possible, means for ingress to permit of examination and cleaning of the inner surfaces of plates and tubes exposed to flame. When the boilers are too small to permit of this there must be sight holes and mudholes sufficiently large and numerous to permit of the inside being satisfactorily cleaned.

5. When the cross tubes of vertical boilers are large there must be a sight hole in the shell opposite to one end of each tube sufficiently large to permit the tube to be examined and cleaned. These sight holes must be in positions accessible for that purpose.

Section 17. In all new boilers working at pressures up to 100 lbs. per square inch the hydraulic test must be twice the working pressure. For boilers working at pressures greater than 100 lbs. per square inch the hydraulic test pressure must be $1\frac{1}{2}$ times the working pressure plus 50 lbs. per square inch.

Section 18. 1. Every boiler must have at least two independent means of indicating the water level in it, and have marked on it in a contiguous position, easily seen, the level of the highest part of the combustion chamber. One of these means must be a glass gauge or an equivalent. The other may be a set of test cocks.

2. Test cocks, where practicable, should be fitted direct on the boiler shell. A set must consist of at least three cocks except in boilers 7 feet 6 inches in diameter and under when there may be two. For vertical boilers above 7 feet high the set of test cocks must consist of at least three.

3. All single-ended boilers over 16 feet mean diameter shall have a glass water gauge on each side. Single-ended boilers under 16 feet in diameter shall have one glass water gauge near one side and one set of test cocks near the other side.

4. All double-ended boilers shall have a glass water gauge near each end on opposite sides and a set of test cocks at each end.

5. The cocks of all water gauges must be accessible from positions free from danger in the event of the glass breaking.

6. If the water gauges are not fitted directly to the shell of the boiler but to stand pillars or columns, it is desirable that these pillars or columns should be bolted directly to the shell of the boiler. If they are connected to the boiler by means of pipes the pipes must have terminal cocks, not valves, fitted direct to the boiler shell. For boilers exceeding 10 feet in diameter the pillars shall not be less than $2\frac{1}{2}$ inches and the connecting pipes not less than $1\frac{1}{2}$ inches internal diameter. For boilers exceeding 7 feet 6 inches but not exceeding 10 feet in diameter the pillars shall not be less than 2 inches and the pipes not less than $1\frac{1}{4}$ inches internal diameter, and for boilers 7 feet 6 inches in diameter and under the pillars shall not be less than $1\frac{3}{4}$ inches and the pipes not less than 1 inch internal diameter. The upper ends of the connecting pipes must be arranged so that there is no pocket or bend where an accumulation of water from the condensation of the steam can lodge. They should not pass through the uptake if they can be otherwise arranged. If, however, this condition cannot be complied with, they may pass through it by means of a passage at least 2 inches clear of the pipe all round, open for ventilation.

7. A Salinometer cock or valve must be fitted direct to each boiler in a convenient position. It must not be on the water gauge stand-pipe.

8. Each boiler shall have a separate steam pressure gauge. Double-ended boilers shall have a pressure gauge at each end. The gauges are to be placed where they are easily seen.

9. Each boiler must have at least two independent means of feed, each with its own check valve. In vertical boilers one of the means of feed may be an injector.

Section 19. 1. Each boiler must have a blow-off valve fitted direct to the shell. The valve and its connections to the sea need not be more than $1\frac{1}{2}$ inches in diameter, and may be generally about $\frac{1}{10}$th inch in diameter for each foot in diameter of the boiler. It should, however, be not less than $\frac{3}{4}$ inch in diameter.

2. Blow-off valves and scum valves (when these latter are fitted) of two or more boilers may be connected to one common discharge, but when thus arranged there must be screw-down non-return valves fitted for each boiler to prevent the possibility of the contents of one boiler passing to another.

3. The blow-off cock or valve on the ship's side must be fitted above the level of the stokehold plates, in an accessible position, and must be arranged so that it can be readily seen whether it is open or shut. The cock handle must not be capable of being removed unless it is shut, and if a valve is fitted the wheel must be fixed to the spindle. The cock or valve must be fitted with a spigot passing through the plating and a brass or gun-metal ring on the outside.

Section 20. One main stop valve must be fitted to each boiler direct on the shell of the boiler. There shall be as few auxiliary stop valves as possible so as to avoid piercing the boiler shell more than is absolutely necessary. The arrangement, however, must be such that when more than one boiler is fitted it is possible to supply the steam whistle, the steam steering gear, and the electric light machinery from at least two boilers.

Section 21. 1. At least two safety valves must be fitted to each boiler. They must be arranged so that the springs and valves are cased in, that the valves cannot be overloaded when steam is up, that they can be lifted by easing gear, and turned round on their seats by hand, and in case of fracture of springs they cannot lift out of their seats. Easing gear must be arranged to lift all the safety

valves on a boiler together, and must be workable from some accessible place, free from steam danger.

2. Vertical boilers having more than 100 square feet of total heating surface must have two safety valves each not less than 1·5 inches diameter ; those having less than 100 square feet may have one valve not less than 2 inches diameter.

3. All the safety valves of each boiler may be fitted in one chest, which must be separate from any other valve chest and must be connected direct to the boiler by a strong and stiff neck, the passage through which should have a cross-sectional area at least equal to one-half the aggregate area of the safety valves in the chest. Each safety valve chest shall have a means by which it can be drained ; the drain pipe shall lead to the bilge or tank clear of the boiler.

4. The minimum aggregate area of the safety valves of the ordinary type in each boiler, whether coal fired or oil fired and whether working under natural, forced, or induced draught, shall be found by the following formula :—

Aggregate area of safety valves in square inches

= Total heating surface of boilers in

$$\text{square feet} \times \left(\frac{C}{p + 15}\right)$$

where p is the working pressure in lbs. per square inch. C being 1·25 for boilers using coal, and 1·5 for those using oil fuel, and for all boilers with closed stokehold forced draught.

5. The waste-steam pipe and the passages leading to it should have a cross-sectional area not less in square inches than 0·01 times the total heating surface of the boiler in square feet, nor in any case should it be less than 1·1 times the combined areas of the safety valves as given by the above rule.

6. All safety valves must be set to the required pressure under steam. During a test of 15 minutes with the stop valves closed and under full firing conditions the accumulation of pressure must not exceed 10 per cent. of the loaded pressure. During this test no more feed-water should be supplied than is necessary to maintain a safe-working water level.

Section 22. 1. All boiler mounting valves over $1\frac{1}{2}$ inches diameter, must have outside screws, and all are to be arranged to be shut with a right-hand motion of the wheels, and must have means for clearly indicating whether they are open or shut. The covers must be secured by bolts or studs.

2. All cocks and valves connected to the boiler shall be such that it is seen without difficulty whether they are open or shut. When boiler mountings are secured by studs, the studs must have a full thread holding in the plate for a length of at least one diameter. If the stud hole penetrates the whole thickness of the plate the stud must be screwed right through the plate and be fitted with a nut inside the boiler. Where bolts are used for securing mountings they must be screwed right through the plate with their heads inside the boiler.

3. Where a superheater is fitted which can be shut off from the boiler it must have a separate safety valve fitted with easing gear. The valve as regards construction must comply with the regulations for ordinary safety valves but the easing gear may be fitted to be workable from the stokehold only. The superheater must also be fitted with a drain cock or valve to free it from water when necessary.

4. All stop and safety valve chests and steam-pipe fittings when subjected to saturated steam only may be made of cast iron, but such valve chests and steam-pipe fittings when subjected to steam of a temperature above 425 degrees Fahr. must be of cast steel or other approved material.

RULES FOR DETERMINING THE WORKING PRESSURE TO BE ALLOWED IN NEW BOILERS.

Cylindrical Shells.

Section 23. 1. For the cylindrical shells of steel marine boilers the maximum working pressure (which is designated by W P and is in lbs. per square inch) to be allowed shall be calculated from the following formulæ :—

Where the thickness of the shell plates does not exceed $1\frac{3}{4}$ inches.

$$\mathbf{WP} = \frac{(t - 2) \times \mathbf{S} \times \mathbf{J}}{\mathbf{C} \times \mathbf{D}}$$

Where the thickness of the shell plates exceeds $1\frac{3}{4}$ inches, and the longitudinal seams are made with double butt straps.

$$\mathbf{WP} = \frac{t \times \mathbf{S} \times \mathbf{J}}{2{\cdot}85 \times \mathbf{D}}$$

In the above formulæ

t is the thickness of the shell plates in 32nds of an inch,

S is the minimum tensile strength of the steel shell plates in tons per square inch,

J is the percentage of strength of the longitudinal seams calculated by the methods described below,

C is a coefficient, which is 2·75 when the longitudinal seams are made with double butt straps, 2·83 when the longitudinal seams are made with lap joints and are treble riveted, 2·9 when they are made with lap joints and are double riveted and 3·3 when they are made with lap joints and are single riveted.

D is the inside diameter of the outer strake of plating of the cylindrical shell measured in inches.

2. The percentage of strength of a riveted joint (**J**) is found from the following formulæ (i), (ii), (iii): (i) and (ii) are applicable to any type of joint, (iii) is applicable only to that type of joint in which the number of rivets in the inner rows is double that in the outer row. The lowest value given by the application of these formulæ is to be taken as the percentage of strength of the joint.

(i) Percentage of strength of plate at joint as compared with solid plate $= \frac{100\ (p - d)}{p}$

(ii) Percentage of strength of rivets as compared with solid plate

$$= \frac{100\ (S_2 \times a \times n \times C)}{S_1 \times p \times T}$$

(iii) Percentage of combined strength of the plate at the inner row of rivet holes and of the rivets in the outer row

$$= \frac{100\ (p - 2\,d)}{p} + \frac{100\ (S_2 \times a \times C)}{S_1 \times p \times T}$$

where p = pitch of rivets at outer rows in inches,
d = diameter of rivet holes in inches,
a = sectional area of one rivet in square inches,
n = number of rivets which are fitted in the pitch p,
T = thickness of plate in inches,
C = 1·0 for rivets in single shear as in lap joints,
C = 1·875 for rivets in double shear as in double butt-strapped joints,
S_1 = minimum tensile strength of plates in tons per square inch,
S_2 = shearing strength of rivets, which is taken generally to be 23 tons per square inch, and may be 85 per cent. of the minimum tensile strength of the rivet bars.

3. Where the longitudinal seams are fitted with double butt-strapped joints, the outer butt strap should have at least 0·625 of the strength of the plate, and should be of sufficient thickness to permit of efficient caulking of its outer edges. The inner butt strap should be $\frac{4}{32}$ inch thicker than this.

In cases where the number of rivets in the inner rows is double the number in the outer row, this will require the thickness of the outer strap to be

$$t_o = \frac{5 \times (p - d)}{8 \times (p - 2\,d)} \times T,$$

and that of the inner strap to be at least

$$t_n = \frac{5 \times (p - d)}{8 \times (p - 2\,d)} \times T + \tfrac{4}{32} \text{ inch.}$$

4. In all cases the clear space between a rivet hole and the edge of a plate should not be less than the diameter of the rivet hole, *i.e.*, the centre of the rivet hole should be at least $1\frac{1}{2}$ diameters distant from the edge of the plate.

In joints whether lapped or fitted with butt straps, in which there are more than one row of rivets and in which there is an equal number of rivets in each row, the distance between the rows of rivets should be not less than 0·33 p + 0·67 d with zigzag riveting, or 2 d with chain riveting.

In joints in which the number of rivets in the outer rows is one-half of the number in each of the inner rows, and in which the inner rows are chain riveted, the distance between outer rows and the next rows should be not less than 0·33 p + 0·67 d or 2 d, whichever is the greater, and the distance between the rows in which there are the full number of rivets should be not less than 2 d.

In joints in which the number of rivets in the outer rows is one-half of the number in each of the inner rows, and in which the inner rows are zigzag, the distance between the outer rows and the next rows should be not less than 0·2 p + 1·15 d, and the distance between the rows in which there are the full number of rivets should be not less than 0·165 p + 0·67 d.

In the above p is the pitch of the rivets in the outer rows.

5. The maximum pitch of the rivets in the longitudinal joints of boiler shells is to be—

Maximum pitch in inches = **C** × **T** + $1\frac{5}{8}$ inches,

where **T** is the thickness of the plate in inches and **C** is a coefficient as given in the following table:—

Number of Rivets per pitch.	Coefficients for Lap Joints.	Coefficients for Double Butt-strapped Joint.
1	1·31	1·75
2	2·62	3·50
3	3·47	4·63
4	4·14	5·52
5	—	6·00

6. If holes are cut in the cylindrical shells of boilers for fixing of mountings, the diameters of the holes being greater than $2\frac{1}{2}$ times the thickness of the shell plating plus $2\frac{3}{4}$ inches, compensation must be fitted as in the case of manholes. (*See* Section 15, clause 2.)

7. When more than three screw stays pierce the cylindrical shell in a horizontal line, if d is their diameter and p the pitch, $\frac{100\ (p - d)}{p}$ should not be less than the percentage of strength required for the shell longitudinal joints. If this is not possible, the stays must be arranged out of line with one another longitudinally.

8. The riveting of the seams joining the end plates to the cylindrical shell shall be not less than 42 per cent. of that of the solid shell plate. Where the shell plates exceed $\frac{5}{8}$ inch in thickness the seams connecting the shell plates to the end plates are to be double riveted. Where the shell plates exceed $\frac{1}{2}$ inch in thickness the intermediate circumferential seams of double-ended boilers are to be at least double riveted.

9. The circumferential seam at or near the middle of the length of single-ended boilers shall have a strength of joint not less than 60 per cent. of the solid plate. The inner circumferential seams of double-ended boilers shall have a strength of joint not less than 62 per cent. of the solid plate. In any case there shall be three rows of rivets when single-ended boilers have shell plates over $1\frac{3}{8}$ inch in thickness and when double-ended boilers have shell plates over $1\frac{3}{16}$ inch in thickness.

10. The circumferential seams of the shells of vertical boilers shall have a strength of not less than 42 per cent. of the solid plate. When these seams are not complete circles, and when the shell plates exceed $\frac{5}{8}$ inch in thickness, the riveting shall be double.

Furnaces.

Section 24. 1. The working pressure to be allowed on corrugated furnaces is to be determined by the following formula :—

$$WP = \frac{C\ (t - 1)}{D}$$

where **D** is the external diameter measured at the bottom of the corrugations in inches,

t is the thickness of the furnace plate in 32nds of an inch, measured at the bottom of the corrugation or camber,

C is a coefficient which is 480 for the Fox, Morison, Deighton, Purves, and other similar furnaces, and is 510 for the Leeds Forge Bulb Suspension furnace.

2. The working pressure to be allowed on plain furnaces or furnaces strengthened by the Adamson or other joints, and on the cylindrical bottoms of combustion chambers, is to be determined by the following formulæ, the least pressure obtained by either formula being taken :—

$$WP = \frac{C\ (t - 1)^2}{(L + 24) \times D}$$

$$\text{or } WP = \frac{C_1}{D} \times [10\ (t - 1) - L]$$

where **D** is the external diameter of the furnace or combustion chamber in inches,

t is the thickness of the furnace plate in 32nds of an inch,

L is the length of the furnace or of combustion chamber bottom or the length between points of substantial support, in inches, measured from the centres of rivet rows or from the commencement of flange curvature, whichever is applicable.

C is 1450 where the longitudinal seams are welded and 1300 where they are riveted.

C_1 is 50 where the longitudinal seams are welded and 45 where they are riveted.

WP is the working pressure in lbs. per square inch.

3. When the furnaces are tapered the diameter to be taken for calculation purposes shall be the mean of that at the top, and of that at the bottom where it meets the substantial support from flange or ring. The length for the same purpose shall be the distance from the centre of the row of rivets connecting the crown to the body of the furnace to the substantial support at the bottom of the furnace, or to a row of screwed stays connecting the furnace to the shell, provided the pitch of stays at the furnace does not exceed 14 times the thickness of the furnace plate when the stays are riveted at their ends, and 16 times when they are fitted with nuts. Such screwed stays must be in diameter over the threads not less than 2·25 times the thickness of the furnace plate.

4. When the furnaces are spherical in form and convex upwards at their tops, and are without support from stays of any kind.

$$WP = \frac{275\ (t - 1)}{R}$$

where t is the thickness of the top plate in 32nds of an inch,

R is the outer radius of curvature of the furnace in inches.

5. For the ogee ring which connects the bottom of the furnace to the shell, and sustains the whole load on the furnace vertically,

$$WP = \frac{140\ (t - 1)^2}{D \times (D - d)}$$

where t is the thickness of the ogee ring in 32nds of an inch,

D is the inside diameter of the boiler shell in inches,

d is the outside diameter of the lower part of the furnace where it joins the ogee ring.

6. No furnace, plain or corrugated, should exceed $\frac{13}{16}$ inch in thickness.

Flat Plates supported by Stays secured in various ways.

Section 25. 1. The working pressure to be allowed on flat plates supported by stays is to be calculated by the following formula :—

$$WP = \frac{(t - 1)^2 \times C}{a^2 + b^2}$$

In this formula and in that in paragraphs 8 to 12

WP is the working pressure in lbs. per square inch,

t is the thickness of the flat plate in 32nds of an inch,

t_w is the thickness of the washers, strips, or doublings employed also in 32nds of an inch,

a is the distance apart of the rows of stays in inches,

b is the pitch of the stays in the rows in inches,

C is a coefficient which varies with the method of fixing the stays as follows :—

Where the plates are exposed to flame and the stays are screwed into the plate and their ends are riveted over C = 50. Where the plates are not exposed to flame and the stays are screwed into the plate and their ends are riveted over C = 57. In these cases the thickness of the plate must be at least half the diameter of the stay required by the Rules.

Where stay tubes are screwed into tube plates and expanded C = 52. If they are fitted with nuts C = 72.

Where the plates are exposed to flame and the stays are screwed into the plate and fitted with nuts on the outside C = 75. Where the plates are not exposed to flame C = 86.

Where the stays pass through the plates not exposed to flame and are fitted with nuts inside and outside C = 96.

2. Where plates are stiffened by flanging, the inner radius of which is not greater than $2\frac{1}{2}$ times the thickness of the plate, for the support thus given C = 110 when the plates are not exposed to flame and C = 96 when they are exposed to flame. The pitch is to be reckoned from the commencement of the curvature.

3. For portions of plate where the stays are irregularly pitched d^2 is to be used instead of $a^2 + b^2$, d being the diameter of the largest circle which can be drawn passing through not less than three points of support, viz., the centres of stays or the commencement of the curvature of flanging whichever is applicable. In this case C is to be taken as the mean of the values appropriate for the points of support.

4. For the tops and sides of combustion chambers the distance between the rows of stays nearest to the back tube plate or the back plate respectively and the commencement of curvature of these plates at their flanges shall not be greater than a.

5. It is desirable that the stays of the combustion chambers should be so placed that the seams of the plates can be caulked without removing the stay nuts.

6. For the tops of combustion chambers where they are joined to the sides by curved portions, if the outer radius of the curved portion is less than half the allowable distance between the girders, the distance between the first girder and the inner surface of the side plate should not exceed the allowable distance between the girders. If the radius of the curved portion is greater than half the allowable distance between the girders, the width of the flat portion measured from the centre of the girder should not be more than half the allowable distance between the girders.

7. Where portions of plate are supported by stays secured in different ways the value of C to be taken is the mean of the values appropriate to the method of securing the supporting stays.

8. Where the plates are supported by stays passing through them and are fitted with nuts inside and washers and nuts outside, the diameter of the washers being at least 3·5 times that of the stay, and their thickness at least two-thirds of that of the plate but not greater than that of the plate the working pressure may be

$$WP = \frac{100}{a^2 + b^2}\left[(t - 1)^2 + 0{\cdot}15\ t_w^2\right]$$

9. Where the washers have a diameter of at least two-thirds of the pitch of the stays and a thickness of at least two-thirds of the thickness of the plate but not greater than that of the plate and are riveted to the plate in an efficient manner :—

$$WP = \frac{100}{a^2 + b^2} [(t - 1)^2 + 0{\cdot}35\ t_w{}^2]$$

10. Where the plate is stiffened by strips at least two-thirds of the pitch of the stays in breadth and have a thickness at least two-thirds of that of the plate but not greater than that of the plate and are riveted to the plate in an efficient manner :—

$$WP = \frac{100}{a^2 + b^2} [(t - 1)^2 + 0{\cdot}55\ t_w{}^2]$$

11. Where the plates are fitted with doubling plates having a thickness of at least two-thirds of that of the plate but not greater than that of the plate and are riveted to them :—

$$WP = \frac{100}{a^2 + b^2} [(t - 1)^2 + 0{\cdot}85\ t_w{}^2]$$

12. For the portions of tube plates in the nests of tubes

$$WP = \frac{C\ (t - 1)^2}{p^2}$$

where t is the thickness of the tube plate in 32nds of an inch,

p is the mean pitch of the stay tubes supporting any portions of the plate (being the sum of the four sides of the quadrilateral divided by 4),

C = 38 when the stay tubes are screwed and expanded into the plate and no nuts are fitted,

C = 49 when the stay tubes are screwed and expanded into the plates and fitted with nuts.

13. For the wide water spaces of front tube plates between the nests of tubes and between the wing rows of tubes and the shell

$$WP = \frac{C[(t-1)^2 + 0{\cdot}55 t_w{}^2]}{a^2 + b^2}$$

where t is the thickness of the front tube plate in 32nds of an inch,

t_w is the thickness of the doubling plate, when so fitted in 32nds of an inch,

a is the horizontal pitch of stay tubes in inches measured across the wide water space,

b is the vertical pitch of stay tubes in the bounding rows, in inches, measured from centre to centre,

C = 52 when the stay tubes are screwed and expanded into the tube plate and no nuts are fitted,

C = 72 when the stay tubes are screwed and expanded into the tube plates, and nuts are fitted to each stay tube,

C = 63 when the stay tubes are screwed and expanded into the tube plates, and nuts are fitted only to alternate stay tubes.

14. If steel of less strength than 26 tons per square inch is used for flat plates, the working pressure allowed shall be correspondingly reduced.

Section 26. The pressure to be allowed on tube plates shall be calculated by the following formula, in which the compressive stress is taken at 14,000 lbs. per square inch :—

$$WP = 875 \times \frac{(D - d) \times t}{W \times D}$$

where t is the thickness of the tube plate in 32nds of an inch.

D is the horizontal distance apart of the tubes, centre to centre in inches,

d is the internal diameter of the plain tubes,

W is the width of combustion chamber measured inside from tube plate to back chamber plate, or between tube plates in double-ended boilers with combustion chambers common to two opposite furnaces.

Section 27. When vertical boilers have a nest or nests of horizontal tubes so that there is direct tension on the tube plates due to the vertical load on the boiler ends or to their acting as horizontal ties across the shell, the thickness of the tube plates and the spacing of the tubes must be such that the section of metal taking the load is sufficient to keep the stress within that allowed on the shell plates.

Further, each alternate tube in the outer vertical rows of tubes must be a stay tube. The tube plates between the stay tubes must be in accordance with the rules for tube plates as in Section 25, clause 12, and in addition

$$WP = \frac{(t - 2) \times S \times (p - d) \times 100}{2{\cdot}9 \times D \times p}$$

where S is the minimum tensile strength of the steel plate in tons per square inch,

t is the thickness of the tube plate in 32nds of an inch,

D is twice the radial distance of the centre of the outer row of tube holes from the axis of the shell in inches,

p is the vertical pitch of tubes,

d is the diameter of the tube holes in inches.

Girders.

Section 28. For girders supporting the tops of combustion chambers the following formula is to be used :—

$$WP = \frac{C \times d^2 \times t}{(L - P) \times D \times L} \times \frac{S}{28}$$

where d is the depth of the girder at centres in inches ;

t is the thickness of the girder at centre, when this is a forging, or the sum of the thicknesses of the plates when the girder is made of two plates, measured in 32nds of an inch ;

L is the length of the girder in inches, measured between the tube plate and back chamber plate inside, or between tube plates in chambers common to two opposite furnaces ;

P is the pitch of stays supported by the girder, in inches ;

D is the distance apart of the girders, centre to centre, in inches ;

S is the minimum tensile strength of the steel plates forming the girder, in tons per square inch. In the case of forged girders **S** is to be taken as 24 for iron and 28 for steel ;

C is a coefficient as follows :—

$$C = \frac{n}{n + 1} \times 495,$$

when the number of stays in each girder is odd,

$$= \frac{n + 1}{n + 2} \times 495,$$

when the number of stays in each girder is even, n being the number of stays to each girder.

Stays.

Section 29. 1. For screw stays with threads not coarser than 9 threads per inch, made of steel or of special wrought iron tested to the requirements of the Rules (Sections 33, 34), the following formula is to be used, but in no case must the stress exceed 9,000 lbs. per square inch :—

$$WP = \frac{(d - 0{\cdot}267)^2 \times 8250}{a}$$

where d is the diameter of the stay over the thread in inches,

a is the area in square inches supported by one stay.

2. For steel longitudinal stays with threads not coarser than 6 threads per inch the working pressure is to be calculated from the following formula, but in no case must the stress exceed 11,000 lbs. per square inch when steel of a minimum tensile strength of 28 tons per square inch is used :—

$$WP = \frac{(d - 0{\cdot}340)^2 \times 9500}{a} \times \frac{S}{28}$$

where d is the diameter of the stay over the thread in inches,

a is the area in square inches supported by one stay.

S is the minimum tensile strength of the steel in tons per square inch.

3. In cases where longitudinal stays are made with enlarged ends and the body of the stay is smaller in diameter than at the bottom of the thread, and in cases where coarser threads than 6 per inch are used the working pressure is to be calculated from the following formula :—

$$WP = \frac{(d^1 - 0{\cdot}125)^2 \times 9500}{a} \times \frac{S}{28}$$

where d^1 is the diameter of the stay at the bottom of the thread or at the smallest part of the body.

Boiler Tubes, Plain and Stay.

Section 30. 1. The following table gives the working pressures permissible with plain boiler tubes of standard thicknesses, whether of lapwelded wrought iron or of lapwelded or seamless mild steel :—

Outside Diameter of tube in inches.	Standard thicknesses in L. S. G.				Working pressures in lbs. per sq. inch.			
	A	B	C	D	A	B	C	D
2		11	10	9		155	215	300
2¼	11	10	9	8	140	190	260	315
2½	11	10	9	8	125	175	230	300
2¾	11	10	9	8	110	160	215	275
3	10	9	8	7	140	190	250	300
3¼	10	9	8	7	130	180	230	280
3½	10	9	8	7	120	165	215	260

2. On stay tubes, whether of wrought iron or of lap-welded steel, a working stress of 7,500 lbs. per square inch of the net sectional area at the bottom of the thread is allowed.

3. The minimum thickness of stay tubes measured under the threads shall be $\frac{1}{4}$ inch for marginal stay tubes and $\frac{3}{16}$ inch for other stay tubes.

4. Stay tubes are to be screwed at both ends with continuous threads, and the holes in the tube plates are to be tapped with continuous threads. The thread should not be finer than 10 threads per inch. It is desirable however that they should be screwed to the standard 9 threads per inch, and after June 30th, 1921 this should be the rule. The stay tubes are to be expanded by roller expanders and not made tight by caulking only.

5. No nuts are to be fitted to stay tubes at the combustion chamber end.

6. If stay tubes are required to have their thickness increased at the screwed ends so that the thickness at the bottom of thread is practically the same as in the body of the tube, the thickening is to be attained by upsetting and not by any welding process, and the tubes are to be annealed after the upsetting.

Section 31. 1. For ends of steam chests, crowns of vertical boilers, etc., dished outwards to partial spherical form and not fitted with stays the following formula is to be used :—

$$WP = \frac{15 \times S\,(t - 1)}{R}$$

WP is the working pressure in lbs. per square inch,
t the thickness in 32nds of an inch,
R the inner radius of curvature of the end in inches which shall not exceed the diameter of shell,
S the minimum tensile strength of plates.

The inside radius of curvature at the flange connecting the end to the cylindrical shell must not be less than 4 times the thickness of the end plate and in no case less than 2·5 inches.

2. When the end has a manhole in it $\frac{4}{32}$ inch must be added to the thickness of plate.

If the plate at the manhole is stiffened by flanging, the total depth of the flange from the outer surface, in inches, is to be at least

$$= \sqrt{t \times w}$$

t is the thickness of plate in inches,
w is the minor axis of the hole in inches.

3. When the end or crown is a complete hemisphere without stays or other supports, and is made in more than one plate, the working pressure to be allowed is given by the following formula :—

$$WP = \frac{(t - 2)\,S \times J}{C \times R}$$

where t is the thickness of the plates in 32nds of an inch.
S is the minimum tensile strength of the steel plates in tons per square inch.
J is the strength of riveted joint per cent. of the solid plate.
R is the inner radius of curvature in inches.
C is a coefficient which for treble riveting is 2·83, for double riveting is 2·9, and for single riveting is 3·3.

Spare Gear.

Section 32. The articles of spare gear mentioned in the following list will be required to be carried in all steam vessels fitted with Reciprocating Engines classed in the Society's Register Book, viz. :—

2 connecting rod or piston rod top-end bolts and nuts.
2 connecting rod bottom-end bolts and nuts.
2 main bearing bolts.
1 set of coupling bolts.
1 set of feed and bilge pump valves.
1 set of piston springs (where common springs are used).
A quantity of assorted bolts and nuts.
Iron of various sizes.

In addition to the foregoing the following articles are recommended to be carried with a view to expedite repairs and lessen delay in distant ports, viz. :—

Crank shaft.
Propeller shaft.
Propeller, or a full set of blades.
Stern bush, or lignum vitæ lining for bush.
1 pair of connecting rod brasses.
1 pair of cross head brasses.
1 set of link brasses.
1 eccentric strap complete.
Air pump rod.
Circulating pump rod.
H. P. valve spindle.
L.P. valve spindle.
1 set of check valves.
6 cylinder cover bolts.

6 junk ring bolts.
4 valve chest cover bolts.
2 dozen boiler tubes.
3 dozen condenser tubes.
1 cylinder escape valve and spring.
1 set of safety valve springs.

Spare Gear for Steam Turbine Engines.

In vessels classed in the Society's Register Book fitted with Steam Turbine Engines the articles of spare gear mentioned in the following list will be required to be carried, viz.:—

2 bolts and nuts (or studs and nuts) for each size of rotor bearing.
2 bolts and nuts (or studs and nuts) main gear wheel bearing.
2 bolts and nuts (or studs and nuts) pinion bearing.
1 set of coupling bolts of each size used.
One-twentieth of total number of bolts and nuts (or studs and nuts) for each gear case joint.
One-twentieth of total number for each Turbine casing joint.
2 thermometers for oil circulating system.
1 set of bearing bushes for one gear wheel shaft.
1 set of bearing bushes for rotor.
1 set of bearing bushes for pinion shafts.
One half set of packing rings or segments for each gland of rotor shafts so fitted and half the number of springs fitted.
2 ordinary thrust horseshoes (or thrust rings) for main thrust block, or sufficient pads for one face of Michell type of main thrust block.
Turbine thrust and adjusting bushes with rings complete, or one set of pads of Michell type for one turbine of each size fitted.
1 set of liners for adjusting block of different thicknesses.
1 set of feed pump valves.
1 set of bilge pump valves.
1 set of valves for lubricating oil pump.
1 bucket and rod for lubricating oil pump.
1 escape valve spring of each size fitted.
A quantity of assorted bolts, studs and nuts.
Bars and plates of iron or mild steel.

In addition to the foregoing, the following articles are recommended to be carried with a view to expedite repairs and lessen delay in distant ports, viz. :—

1 propeller of each hand, or one set of blades of each hand.
1 propeller shaft.
Lignum Vitæ lining for one stern bush.
Sufficient material for one gland and one dummy ring of each size where labyrinth packing is used.
1 air pump rod, bucket and valves.
1 circulating pump rod, bucket and valves, or impeller and shaft.
2 doz. boiler tubes.
5% of the number of condenser tubes and packing glands for same.
10% of the tubes for oil cooler and packing glands for same.
1 set of boiler feed check valves.
1 set of safety valve springs.

QUALITY AND TESTING OF BOILER MATERIAL.

Steel Plates, Bars and Angles.

Section 33. 1. When steel is used in the construction of boilers intended for vessels classed or proposed for classification in the Society's Register Book, the boilers shall be constructed in accordance with the requirements of the Rules, and the following conditions be fulfilled :—

2. **Process of Manufacture.**—Steel for Marine Boilers shall be made by the Open Hearth process, Acid or Basic.

3. **Freedom from Defects.**—The finished material shall be free from cracks, surface flaws, and lamination. It shall also have a workmanlike finish, and must not have been hammer-dressed.

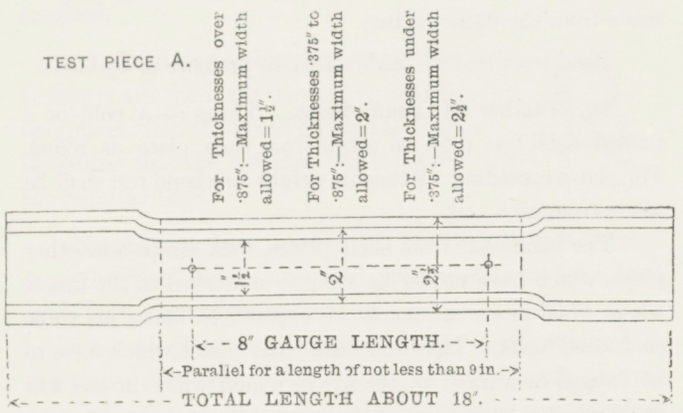
4. **Testing and Inspection.**—The following tests and inspections shall be made at the place of manufacture prior to despatch ; but, in the event of any of the material proving unsatisfactory in the course of being worked into boilers, such material shall be rejected, notwithstanding any previous certificate of satisfactory testing, and such further tests of the material from the same charge may be made as the Surveyor may consider desirable.

5. **Tensile Test Pieces.**—The tensile strength and ductility shall be determined from Standard test pieces cut lengthwise or crosswise from the rolled material. When material is annealed or otherwise treated before despatch, the test pieces shall be similarly and simultaneously treated with the material before testing.

Plates :—Wherever practicable the rolled surfaces shall be retained on two opposite sides of the test piece. The elongation shall be measured on a Standard test piece having a gauge length of 8 inches.

For material more than ·875 in. in thickness the width of the test piece between the gauge points shall not exceed $1\frac{1}{2}$ ins.; for material ·875 in. to ·375 in. in thickness, inclusive, the width shall not exceed 2 ins.; for material less than ·375 in. in thickness the width shall not be more than $2\frac{1}{2}$ ins. In other respects the test pieces shall conform generally to the Standard test piece A.

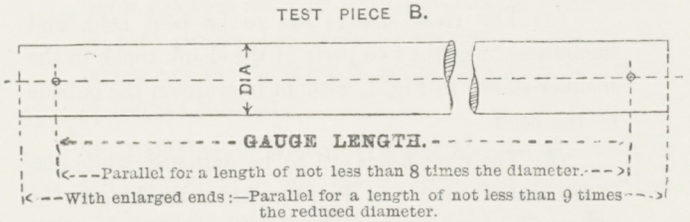
TEST PIECE A.



Round Bars:—Bars may be tested full size as rolled, or they may be turned down to a convenient size, and if tested 1 inch in diameter, or under, the test piece shall have a gauge length of 8 times the diameter. When enlarged ends are used the length of the parallel portion shall not be less than 9 times the reduced diameter (*see* Standard test piece B.)

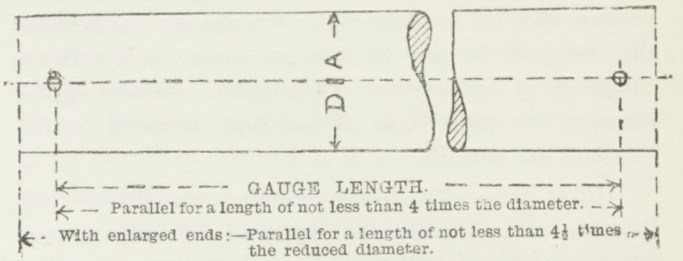
The sectional area of the test piece shall not be less than $\frac{1}{4}$ square inch.

TEST PIECE B.



Where bars are above one inch diameter, and are tested full size as rolled, or have been turned down and the resulting test piece is above one inch diameter, a gauge length of 4 times the diameter may be used if preferred by the Manufacturer, in which case an increased elongation will be required, as specified in clause 7. When enlarged ends are used, the length of the parallel portion shall be not less than $4\frac{1}{2}$ times the reduced diameter (*see* Standard test piece C.)

TEST PIECE C. (BRITISH STANDARD TEST PIECE F.)



Any straightening of test pieces which may be required shall be done cold.

6. **Mechanical Tests and Selection of Test Pieces.**—Plates and bars for boilers shall comply with the following mechanical tests. All test pieces shall be selected by the Surveyor and tested in his presence, and he shall satisfy himself that the conditions herein described are fulfilled.

7. **Tensile Tests.** Plates:—The tensile breaking strength of steel plates for shells and girders, determined from Standard test pieces, shall be between the limits of 28 and 35 tons per square inch, but a range of not more than 4 tons per square inch shall be permitted in any one case. For plates intended for flanging or welding, and for combustion chambers and furnaces, the tensile breaking strength shall be between the limits of 26 and 30 tons per square inch. The elongation, measured on a Standard test piece having a gauge length of 8 ins., shall not be less than 20 per cent. for material of ·375 in. in thickness and upwards required to have a tensile breaking strength between the limits of 28 and 35 tons per square inch; and not less than 23 per cent. for material of ·375 in. in thickness and upwards required to have a tensile breaking strength between the limits of 26 and 30 tons per square inch.

Angle and Tee Bars:—The tensile breaking strength of angle and tee bars shall be between the limits of 28 and 32 tons per square inch, with an elongation of not less than 20 per cent. measured on the Standard test piece A.

For material of plates, angles, or tee bars under ·375 in. in thickness the elongation may be 3 per cent., but not more than 3 per cent., below the above-named elongations.

Wherever practicable the rolled surfaces shall be retained on two opposite sides of the test pieces.

Stay Bars:—The tensile breaking strength of longitudinal stay bars shall be between the limits of 28 and 35 tons per square inch, with an elongation of not less than 20 per cent. measured on the Standard test piece B, or 24 per cent. measured on the Standard test piece C; but a range of not more than 4 tons per square inch shall

be permitted in any one case. For steel bars for combustion chamber stays the tensile breaking strength shall be between the limits of 26 and 30 tons per square inch, with an elongation of not less than 23 per cent. measured on the Standard test piece B, or 28 per cent. measured on the Standard test piece C.

Rivet Bars:—The tensile breaking strength of rivet bars shal be between the limits of 26 and 30 tons per square inch of section, with an elongation of not less than 25 per cent. measured on the Standard test piece B or 30 per cent. measured on the Standard test piece C. The bars may be tested the full size as rolled.

8. **Number of Tensile Tests.** Plates.—One tensile test shall be taken from each plate as rolled. For plates exceeding $2\frac{1}{2}$ tons in weight one tensile test shall be taken from each end.

Angle, Tee, Rivet and Stay Bars :—One tensile test shall be made from each 15 or part of 15 bars rolled of each section or diameter from the same charge, but not less than two tensile tests shall be made unless the total number of bars rolled from the same charge is 8 or less than 8 and the bars are of the same section or diameter, in which case one tensile test will suffice. For round bars of $1\frac{3}{4}$ inch diameter and under, the numbers 50 and 20 shall be substituted for 15 and 8 respectively for determining the number of tests required.

Should a tensile test piece break outside the middle half of its gauge length, and the elongation be less than that required by the Rules the test may, at the Maker's option, be discarded and another test be made of the same plate or bar.

9. **Bend Tests.** Cold Bends:—Test pieces shall be sheared lengthwise or crosswise from plates or bars, and shall not be less than $1\frac{1}{2}$ ins. wide, but for small bars the whole section may be used. For rivet bars bend tests are not required.

Temper Bends:—The test pieces shall be similar to those used for cold bend tests. For temper bend tests the samples shall be heated to a blood red and quenched in water at a temperature not exceeding 80 degrees Fahr. The colour shall be judged indoors in the shade.

In all cold bend tests, and in temper bend tests on samples ·5 in. in thickness and above, the rough edge or arris caused by shearing may be removed by filing or grinding, and samples 1 in. in thickness and above may have the edges machined, but the test pieces shall receive no other preparation. The test pieces shall not be annealed unless the material from which they are cut is similarly annealed, in which case the test pieces shall be similarly and simultaneously treated with the material before testing.

For both cold and temper bends the test piece shall withstand, without fracture, being doubled over until the internal radius is equal to $1\frac{1}{2}$ times the thickness of the test piece, and the sides are parallel.

For small sectional material these bend tests may be made from the flattened bar.

Bend tests may be made either by pressure or by blows.

10. **Number of Bend Tests.** Plates:—A cold or a temper bend test shall be taken from each plate as rolled. For plates exceeding $2\frac{1}{2}$ tons in weight one bend test shall be taken from each end.

The bend tests from shell plates, butt straps and other plates which have not to be flanged or worked in the fire or which when in use are not to be exposed to flame, are to be cold bend tests. The bend tests from plates which have to be flanged or worked in the fire or which when in use will be exposed to flame are to be temper bend tests. In the cases of shell plates permitted to have a tensile strength above 34 tons per square inch one temper bend must be made in addition to the cold bends above specified in the case of each plate which is above 34 tons per square inch.

Angle Bars:—A cold or a temper bend test shall be made from each angle bar rolled.

Stay Bars:—A cold and temper bend test shall be made from every 15 stay bars as rolled from each charge.

11. **Tests for Manufactured Rivets.**—Rivets selected by the Surveyor from the bulk shall withstand the following tests:—

(*a*) The rivet shanks are to be bent cold, and hammered until the two parts of the shank touch in the manner shown in Fig. 1, without fracture on the outside of the bend.

(*b*) The rivet heads are to be flattened, while hot, in the manner shown in Fig. 2, without cracking at the edges. The heads are to be flattened until their diameter is $2\frac{1}{2}$ times the diameter of the shank.

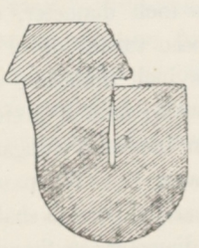


FIG. 1.

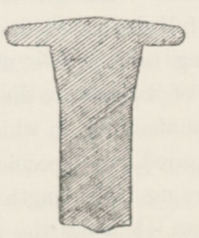
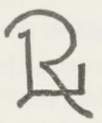


FIG. 2.

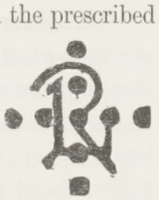
12. **Additional Tests before Rejection.**—Should any of the test pieces first selected by the Surveyor not fulfil the test requirements, two further tests of the same kind may be made from the same plate or bar, but should either of these fail, the plate or bar from which the test pieces were cut shall be rejected. In all such cases further tests shall be made before any material from the same charge can be accepted.

13. **Branding.**—Every plate and bar shall be clearly and distinctly marked by the Maker in two places with the Society's brand, thus :—  indicating that the material has complied with the required tests.

No plates or bars bearing this brand shall be forwarded from the Steel Works until the prescribed tests have been made by the Surveyor, and the mill sheets have been signed by him. All plates and bars shall also be legibly stamped in two places with the Maker's name or trade mark, and the place where made. They shall also be stamped with numbers or identification marks by which they can be traced to the charge from which the material was made.

14. **Maker's Certificate.**—Before the mill sheets are signed by the Surveyor, the Maker shall furnish him with a certificate guaranteeing that the material has been made by the Open Hearth process, and that it has been subjected to, and has withstood satisfactorily, the tests above described in the presence of the Surveyor. The following form of certificate will be accepted if printed on each mill sheet with the name of the firm, and initialled by the Test House Manager :—

> "We hereby certify that the material described below has been made by the Open Hearth process, and is that which has been satisfactorily tested in the presence of the Surveyor in accordance with the Rules of Lloyd's Register."

15. **Defacing of Rejected Material.**—In the event of the material failing, in any case, to withstand the prescribed tests, the Surveyor shall see that the Society's brand stamped on the plates and bars by the Maker has been defaced by punch marks extending beyond the brand in the form of a cross, thus :—  denoting that the material has been rejected.

16. **Facilities for Inspection.**—The Maker shall adopt a system of marking the ingots, billets, slabs, plates, bars, etc., which will enable all finished material to be traced to the original charge, and the Surveyor must be given every facility for tracing all plates and bars to their respective charges, and for witnessing the required tests. When he is satisfied with the material and with the results of the tests, he shall be furnished with two copies of the advice notes of the material for his signature, one of which is to be forwarded by the Manufacturer to the Boiler Maker, and the other is to be forwarded by the Surveyor to the Surveyors at the port where the boiler is to be built.

17. **Steel not produced where Rolled.**—Where steel is not produced in the works at which it is rolled, a certificate shall be supplied to the Surveyor, stating the Open Hearth process by which it was made, the name of the Steel Maker who supplied it, also the numbers of the charges for reference to the books of the Steel Maker. The number of the charge shall be marked on each ingot or billet for the purpose of identification, and the finished plates and bars shall also be legibly stamped in two places with the Maker's name or trade mark, and the place where made. They shall also be stamped with numbers or identification marks by which they can be traced to the charge from which the material was made.

18. **General.**—Besides the foregoing tests, samples of all material may be subjected to additional tests at the discretion of the Surveyors.

19. In cases wherein it may be desired by Owners and Builders, consideration will be given by the Committee to proposals for the use of steel of other tenacity than is provided for in the foregoing Rules.

SPECIAL IRON FOR SCREW STAYS FOR COMBUSTION CHAMBERS.

Section 34. 1. In order that iron screw stays may be approved of the same size as would be required for mild steel the iron must withstand the following tests :—

2. The tensile breaking strength shall not be less than $21\frac{1}{2}$ tons per square inch, with an elongation of not less than 25 per cent. measured on the Standard test piece B, or of 30 per cent. measured on the Standard test piece C.

3. Test pieces, either of the bar as rolled or turned down to 1 inch diameter, shall stand bending cold until the sides are parallel and the space between the two sides is not greater than the diameter of the test piece.

4. The bars as rolled are to be placed in batches of 20, and one tensile test is to be taken from each batch. If this is unsatisfactory, two other bars are to be selected for test, but should either of these fail the batch is to be rejected.

5. One ordinary bend test is to be taken from each batch, and a similar test piece from each batch is to be lightly and evenly nicked on one side with a sharp cutting tool and bent back at this point through an angle of 180°

by pressure or by a succession of light blows. The fracture must be clean, fibrous, free from slag or dirt or any coarse crystalline structure. If either of these is unsatisfactory, two other bars are to be selected for test, but should either of these fail the batch is to be rejected.

6. In all cases the selection of the test pieces is to be made by the Surveyors.

QUALITY AND TESTING OF STEEL CASTINGS.

Section 35. 1. **Process of Manufacture.**—Steel for castings shall be made by the Open Hearth process, Acid or Basic, or by such other process as may be approved by the Committee.

2. **Annealing.**—All steel castings shall be thoroughly annealed in a properly constructed annealing furnace, which must permit of the whole casting being uniformly raised in temperature throughout its whole extent to the necessary intensity required for annealing purposes. The casting shall be allowed to cool down prior to removal from the annealing furnace; and if subsequently heated for any purpose it shall again be similarly annealed if required by the Surveyor.

3. **Testing and Inspection.**—The following tests and inspections shall be made, preferably at the place of manufacture prior to despatch, but in the event of any casting proving unsatisfactory in the course of preparation or erection, such casting shall be rejected notwithstanding any previous certificate of satisfactory testing.

4. **Tensile and Bend Test Pieces.**—The tensile strength and ductility shall be determined from standard test pieces, which are to be prepared from sample pieces cast on the casting. These sample pieces are not to be cut or partially cut from the castings until the annealing of such castings has been completed, nor until they have been stamped by the Surveyor. The test pieces are to be stamped by the Surveyor after the annealing. All test pieces shall be selected by the Surveyor and tested in his presence, and he shall satisfy himself that the conditions herein described are fulfilled.

5. **Number of Tests.**—At least one tensile test and one cold bend test are to be taken from each casting. In castings of complex design, referred to in paragraph 12, at least two tensile and two cold bend tests are to be taken. Where a casting is made from more than one charge of steel, at least four tensile and four cold bend tests are to be taken from pieces cast as far apart as possible on the casting, some test pieces being taken from as near the top, and others from as near the bottom of the casting as practicable.

6. **Dimensions of Tensile Test Pieces.**—The tensile test pieces are to be turned so as to have a diameter of ·564 inch with a gauge length of 2 inches, or a diameter of ·798 inch with a gauge length of 3 inches, or a diameter of ·977 inch with a gauge length of $3\frac{1}{2}$ inches.

7. **Dimensions of Bend Test Pieces.**—The bend test pieces are to be machined to a rectangular section 1 inch wide by $\frac{3}{4}$ inch thick, with the edges rounded to a radius of $\frac{1}{16}$th of an inch. They are to be bent over the thinner section. The bending may be performed either by pressure or by blows.

8. **Tensile Tests.**—The tensile breaking strength determined from test pieces of standard dimensions is to be between the limits of 26 and 35 tons per square inch with an elongation of not less than 20 per cent. measured on the standard test piece.

9. **Bend Tests.**—The bend test pieces must withstand without fracture being bent cold through an angle of 120 degrees, the internal radius of the bend being not greater than one inch.

10. **Additional Tests before Rejection.**—Should either the tensile or bend test or both fail and the Surveyor consider the fractured test piece or test pieces, or the results obtained therefrom, do not fairly represent the quality of the casting, a duplicate of the test or tests which failed shall be made if requested by the Maker. In such cases the quality of the casting shall be judged by the result of the duplicate test or tests and not by the original test or tests which failed.

11. **Percussive Tests.**—The castings are to be dropped on hard ground from a height of from 7 to 10 feet, according to the design, shape, and weight of the casting.

12. **Castings of Complex Design.**—Castings of complex design which would be liable to be deformed if submitted to the drop or percussive test, may have this test dispensed with provided two tensile and two cold bend tests be made upon pieces taken from positions as far apart as possible on each casting; one tensile and one bend test being taken from as near the top and the others from as near the bottom of the casting as practicable.

13. **Hammering Tests.**—After being subjected to the percussive test, the casting in each case is to be subsequently slung up and well hammered with a sledge hammer not less in weight than 7 lbs., to satisfy the Surveyors that the casting is sound and without flaw. This hammering test is also to be applied to castings of complex design which may not have been submitted to a percussive test.

14. When the castings are to be used for purposes for which cast iron is ordinarily employed they need not be submitted to tensile and bend tests, but they must be submitted to the drop and hammering tests specified in paragraphs 11 and 13.

15. **Branding.**—Every casting after it has satisfactorily withstood the prescribed tests, shall be clearly and distinctly marked by the Society's Surveyor indicating that the casting has complied with the Society's requirements.

QUALITY AND TESTING OF INGOT STEEL FORGINGS.

Section 36. 1. **Process of Manufacture.**—Ingot steel for forgings shall be made by the Open Hearth process, Acid or Basic, or by such other process as may be approved by the Committee.

The forgings must be sound; they are to be made from sound ingots, and for all important forgings such as crank and propeller shafts, connecting rods and piston rods, the forgings must be gradually and uniformly forged. The sectional area of the body of the forging (as forged) shall not exceed one-fifth of the sectional area of the original ingot, and no part of the forging (as forged) shall have more than two-thirds of the sectional area of the original ingot.

2. **Annealing.**—All important ingot steel forgings shall be thoroughly annealed in a properly constructed annealing furnace, which must permit of the whole forging being uniformly raised in temperature throughout its whole extent to the necessary intensity required for annealing purposes. If the forging be subsequently heated for any further forging it shall again be similarly annealed, if required by the Surveyor.

3. **Testing and Inspection.**—The following tests and inspections shall be made, preferably at the place of manufacture prior to despatch, but in the event of any forging proving unsatisfactory in the course of preparation or erection, such forging shall be rejected notwithstanding any previous certificate of satisfactory testing.

4. **Tensile and Bend Test Pieces.**—The tensile strength and ductility shall be determined from standard test pieces which are to be prepared from sample pieces cut lengthwise from the forging from a part of not less sectional dimensions than the body of the forging. Such standard test pieces shall be machined from the sample pieces without forging down, and the sample pieces shall not be detached from the forging until the annealing of such forging has been completed. The test pieces are to be stamped by the Surveyor after the annealing. All test pieces shall be selected by the surveyor and tested in his presence, and he shall satisfy himself that the conditions herein described are fulfilled.

5. **Number of Tests.**—At least one tensile and one cold bend test are to be taken from each forging. Where a number of articles are cut from one forging, one tensile and one cold bend test from this whole forging will be sufficient.

6. **Dimensions of Tensile Test Pieces.**—The tensile test pieces are to be turned so as to have a diameter of ·564 inch with a gauge length of 2 inches, or a diameter of ·798 inch with a gauge length of 3 inches, or a diameter of ·977 inch with a gauge length of $3\frac{1}{2}$ inches.

7. **Dimensions of Bend Test Pieces.**—The bend test pieces are to be machined to a rectangular section 1 inch wide by $\frac{3}{4}$ inch thick, with the edges rounded to a radius of $\frac{1}{16}$th of an inch. They are to be bent over the thinner section. The bending may be performed either by pressure or by blows.

8. **Tensile Tests.**—The tensile breaking strength determined from test pieces of standard dimensions is to be between the limits of 28 and 32 tons per square inch with an elongation on the standard test piece of not less than 29 per cent. for 28 ton steel, and 25 per cent. for 32 ton steel, and in no case must the sum of the tensile breaking strength and corresponding elongation be less than 57.

9. **Bend Tests.**—The bend test pieces must withstand without fracture being bent cold through an angle of 180 degrees, the internal radius of the bend being not greater than $\frac{1}{4}$ inch.

10. **Additional Tests before Rejection.**—Should either the tensile or bend test, or both, fail, and the Surveyor consider the fractured test piece or test pieces, or the results obtained therefrom, do not fairly represent the quality of the forging, a duplicate of the test or tests which failed shall be made if requested by the Maker. In such cases the quality of the forging shall be judged by the result of the duplicate test or tests and not by the original test or tests which failed.

11. **Branding.**—Every forging after it has satisfactorily withstood the prescribed tests, shall be clearly and distinctly marked by the Society's Surveyor indicating that the forging has complied with the Society's requirements.

12. **General.**—The requirements as to annealing and testing are intended to apply to shafts of all descriptions, also to connecting rods and piston rods which require to be made in several heats. They are not intended to apply to small forgings which during their last stage of manufacture are uniformly heated throughout.

PERIODICAL SURVEYS. (*See* N.B.)

Section 37. 1. The machinery and boilers of all steam ships and the donkey boilers of sailing vessels are to be surveyed annually if practicable, and in addition are to be submitted to a Special Survey upon the occasions of the vessels undergoing the Special periodical Surveys Nos. 1, 2, and 3, prescribed in the Rules, unless the machinery and boilers have been specially surveyed within a period of twelve months.

2. At these Special Surveys, and on other occasions if deemed necessary by the Surveyors, the propeller, stern-bush, sea connections, and their fastenings, are to be examined while the vessel is in dry dock.

3. The screw shaft is to be examined annually and drawn at intervals of not more than three years in the cases of shafts fitted with continuous liners, and of shafts fitted with approved glands, or other approved appliances, at their after ends to permit of them being efficiently lubricated. In the cases of other shafts, they should be drawn at intervals of not more than two years. (On the application of owners, the Committee will be prepared to give consideration to the circumstances of any special case.)

4. The cylinders, pistons, slide valves, crank, thrust and tunnel shafts, and pumps are to be examined, and if necessary the condenser is to be examined and tested.

5. The arrangements of cocks, pipes, bilge-suctions, roses, etc., are to be examined.

6. The boilers and superheaters are to be examined internally and externally, and if deemed necessary by the Surveyors, both boilers and superheaters are to be drilled or tested by hydraulic pressure ; the safe working pressure is to be determined by their actual condition.

7. The steam pipes and the principal boiler mountings are to be examined and the safety valves set to the safe working pressure.

8. If satisfactory, these Surveys will be recorded in the Register Book thus :—" LMC6,21 " *in red* or " B&MS6,21 " *in red.*

9. " LMC " (LLOYD'S MACHINERY CERTIFICATE) denotes that the machinery and boilers are fitted in accordance with the Rules ; and when followed by a date, indicates that they were found at that time to be in good condition. " MS " with a date denotes that the engines at that time were found upon inspection to be in good condition. " BS " with a date denotes that the boilers were found upon inspection at that time to be in good condition.

10. " B&MS " (BOILERS AND MACHINERY SURVEYED), with a date, denotes that the boilers and machinery, though not fitted strictly in accordance with the Rules, were found upon inspection at that time to be in good condition.

11. In the event of either the machinery or boilers appearing to be impaired to such an extent as to render it desirable that either or both be specially surveyed within the periods prescribed above, a Certificate for either machinery or boilers for a limited period will be granted according to the nature of the case.

BOILERS.

12. Water tube boilers are to be specially surveyed annually.

13. The boilers of all steam ships and the donkey boilers of sailing vessels are to be specially surveyed when six years old, and subsequently they are to be specially surveyed annually.

14. At these surveys the boilers and superheaters are to be examined internally and externally, and if deemed necessary by the Surveyors, both boilers and superheaters are to be drilled or tested by hydraulic pressure ; the safe working pressure is to be determined by their actual condition.

15. The steam pipes and the principal boiler mountings are to be examined and the safety valves set to the safe working pressure.

16. If satisfactory these surveys will be recorded in the Register Book thus :—" BS6,21 " *in red* in the case of steam vessels, and " DBS6,21 " *in red* in the case of sailing vessels.

17. " BS " (Boilers Surveyed) or " DBS " (Donkey Boiler Surveyed), with a date, denotes that the boilers were found upon inspection at that time to be in good condition.

18. In the event of the boilers appearing to be impaired to such an extent as to render it desirable that they be specially surveyed within the periods prescribed above, a Certificate for a limited period will be granted according to the nature of the case.

N.B.—In reference to the Rules above quoted, and in order to prevent the disappointment arising from Ships losing their Characters from want of survey, it is hereby intimated that the duty of giving NOTICE OF PERIODICAL SURVEYS *required by the Rules, or when repairs are necessary in consequence of damage, or from other causes, rests with the Owners, Masters, or Agents.*

71, FENCHURCH STREET, LONDON, E.C. 3.
21*st April*, 1921.

By order of the Committee,

ANDREW SCOTT,
Secretary.

RULES FOR THE CONSTRUCTION AND SURVEY OF INTERNAL COMBUSTION ENGINES (OTHER THAN OF THE DIESEL TYPE) FOR MARINE PURPOSES.

GENERAL.

Section 1. In vessels propelled by Internal Combustion Engines, the Rules as regards Machinery will be the same as those relating to steam engines so far as regards the testing of material used in their construction and the fitting of sea connections, discharge pipes, shafting, stern tubes and propellers.

CONSTRUCTION.

Section 2. 1. The following points should be observed in connection with the design of the engines.

2. The shaft bearings, connecting rod brasses, the valve gear, the inlet and exhaust valves must be easily accessible.

3. The reversing gear and clutch must be strongly constructed and easily accessible for examination and adjustment.

4. In engines of above 60 B.H.P. which are not reversible and which are manœuvred by clutch, a governor or other arrangement must be fitted to prevent racing of the engine when de-clutched.

5. In vessels intended for open sea service and fitted with engines in which the lubricating oil is circulated under pressure, a spare oil pump is to be supplied with all connections ready for immediate use, and two independent means are to be arranged for circulating water through the oil cooler, where this is fitted.

6. If the engines are of the closed-in type, they must be so fitted that the contained lubricating oil can be drained when necessary, and in wood vessels an easily drained metal or metal-lined tray must be fitted to prevent leakage of either fuel oil or of lubricating oil from saturating the wood work.

7. Carburettors, where petrol is used, and vaporizers, where paraffin oil is used, should be so designed that when the engine is stopped the fuel supply is automatically shut off. If an overflow is provided in the carburettor or vaporizer, a gauze covered tray with means of draining it must be fitted to prevent the fuel from flowing into the bilges.

Strong metallic gauze diaphragms should be fitted either between the carburettor (or vaporizer) and cylinders, or at the air inlets.

8. If the ignition is electric, either by magneto or by coil and accumulator, all electric leads must be well insulated and suitably protected from mechanical injury. The leads should not be placed where they may be brought into contact with oil or petrol.

The commutator must be enclosed, and the sparking coils must not be placed where they can be exposed to explosive vapour.

9. In paraffin and heavy oil engines where lamps are used for ignition or for vaporizing, these lamps should be fixed by some suitable bracket, and the flame enclosed when in use.

10. The circulating pump sea suction is to have a cock or valve on the vessel's skin placed on the turn of the bilge in an easily accessible position, and the circulating pipe is to be provided with an efficient strainer which can be cleared inside the vessel. The discharge overboard is to be fitted with a cock or valve on the vessel's skin if it is situated under or near the load line of the vessel.

11. The pumping arrangements are to be the same as would be required in the case of a steam vessel of the same size and power, with the exception that no bilge suction to the circulating pump need be fitted. In the cases of vessels fitted with water ballast, the water ballast pump must have, in addition, one direct suction from the engine room bilges.

In open launches, and in small sailing vessels in which the engines are auxiliary only, a suitable additional hand pump, fitted to draw from the engine room bilges, may be accepted in lieu of a power driven pump.

12. Where the cylinder liners are made of hard close grained cast iron of plain cylindrical form, accurately turned on the outside as well as bored on the inside, so that their soundness can be ascertained by inspection, they need not be hydraulically tested by internal pressure. If, however, they are made of complicated form, the question of testing must be submitted.

13. The water jackets of the cylinders, and the water passages of the cylinder covers and pistons must be tested by

hydraulic pressure to 30 lbs. per square inch and must be perfectly tight at that pressure.

14. The exhaust pipes and silencer are to be efficiently water cooled or lagged to prevent damage by heat, and if the exhaust is led overboard near the water-line, means must be arranged to prevent water from being syphoned back to the engine.

15. The machinery must be tried under full working conditions, the report stating the approximate speed of vessel, the number of revolutions of the engines at full power, both ahead and astern, and the lowest number of revolutions of the engines which can be maintained for manœuvring purposes.

RULES FOR DETERMINING SIZES OF SHAFTS.

Section 3. 1. The diameter of the crank shaft must not be less than that given by the following formula :—

$$\text{Diameter of crank shaft} = \sqrt[3]{D^2 \times (AS + BL)}$$

where D = diameter of cylinder in inches or millimetres,

S = length of stroke in inches or millimetres,

L = span of bearings adjacent to a crank measured from centre to centre in inches or millimetres.

The values of $AS + BL$ are as given in the following tables :—

TABLE I.

For Petrol or Paraffin Oil Engines.

4 Cycle Single Acting Engines.	2 Cycle Single Acting Engines.	For Smooth Water Service Values of $AS+BL$	For Open Sea Service Values of $AS+BL$
1, 2, 3 or 4 Cyls.	1 or 2 Cyls.	$\cdot0308S+\cdot0143L$	$\cdot0342S+\cdot0159L$
6 „	3 „	$\cdot0310S+\cdot0143L$	$\cdot0344S+\cdot0159L$
8 „	4 „	$\cdot0351S+\cdot0136L$	$\cdot0389S+\cdot0151L$
12 „	6 „	$\cdot0474S+\cdot0120L$	$\cdot0526S+\cdot0133L$

The above Table applies to Engines in which there are bearings adjacent to each side of each crank. If there are two cranks between consecutive bearings the same Rules will apply, but L will be the span between the centres of the bearings adjacent to the two cranks.

TABLE II.

For Heavy Oil Engines in which the maximum pressure in the cylinders is 200 lbs. per square inch.

4 Cycle Single Acting Engines.	2 Cycle Single Acting Engines.	Values of $AS+BL$
1 up to 8 Cyls.	1 up to 4 Cyls.	$\cdot0298S+\cdot0144L$
12 „	6 „	$\cdot0376S+\cdot0118L$

TABLE III.

For Heavy Oil Engines in which the maximum pressure in the cylinders is 300 lbs. per square inch.

4 Cycle Single Acting Engines.	2 Cycle Single Acting Engines.	Values of $AS+BL$
1 up to 12 Cyls.	1 up to 6 Cyls.	$\cdot0339S+\cdot0195L$

TABLE IV.

For Heavy Oil Engines in which the maximum pressure in the cylinders is 450 lbs. per square inch.

4 Cycle Single Acting Engines.	2 Cycle Single Acting Engines.	Values of $AS+BL$
1 up to 8 Cyls.	1 up to 4 Cyls.	$\cdot0550S+\cdot0320L$
12 „	6 „	$\cdot0570S+\cdot0320L$

TABLE V.

For Heavy Oil Engines in which the maximum pressure in the cylinders is 550 lbs. per square inch.

4 Cycle Single Acting Engines.	2 Cycle Single Acting Engines.	Values of $AS+BL$
1, 2, 3 or 4 Cyls.	1 or 2 Cyls.	$\cdot0643S+\cdot0340L$
6 „	3 „	$\cdot0673S+\cdot0347L$
8 „	4 „	$\cdot0643S+\cdot0340L$
12 „	6 „	$\cdot0673S+\cdot0347L$

2. For heavy oil engines in which the maximum pressure in the cylinders is intermediate between 200 and 300 lbs. per square inch, or between 300 and 450 lbs. per square inch, or between 450 and 550 lbs. per square inch, the

co-efficients of $AS + BL$ are to be interpolated between those given in the above tables.

3. For auxiliary engines of the above mentioned types the diameters of the crank shafts may be 5 per cent. less than given by the foregoing formulæ applying to main engines for open sea service.

4. In solid forged shafts the breadth of the webs should be not less than 1·33, and the thickness not less than 0·56 times the diameter of the shaft as found above, or if these proportions are departed from, the webs must be of equivalent strength.

5. The diameter of the intermediate shaft must not be less than that given by the following formula :—

$$\text{Diameter of intermediate shaft} \ldots = \text{Co-efficient} \times \sqrt[3]{D^2 \times S}$$

where D = diameter of cylinder,
S = stroke of piston,

and the value of the co-efficient is given in the following tables :—

TABLE VI.

For Petrol or Paraffin Oil Engines.

FOR SMOOTH WATER SERVICES.				
4 Cycle Single Acting Engines.	2 Cycle Single Acting Engines.	Values of the Co-efficient C where		
		A=·0025.	A=·0050.	A=·0100.
2 Cyl.	1 Cyl.	·240	·250	·256
3 „	—	·255	·264	·270
4 „	2 „	·272	·277	·282
6 „	3 „	·298	·301	·304
8 „	4 „	·322	·324	·325
12 „	6 „	·363	·364	·365
FOR OPEN SEA SERVICE.				
4 Cycle Single Acting Engines.	2 Cycle Single Acting Engines.	Values of the Co-efficient C where		
		A=·0025.	A=·0050.	A=·0100.
2 Cyl.	1 Cyl.	·252	·262	·269
3 „	—	·269	·276	·283
4 „	2 „	·286	·291	·296
6 „	3 „	·313	·316	·319
8 „	4 „	·338	·340	·341
12 „	6 „	·382	·382	·383

TABLE VII.

For Heavy Oil Engines in which the maximum pressure is 200 lbs. per square inch.

4 Cycle Single Acting Engines.	2 Cycle Single Acting Engines.	Values of the Co-efficient where		
		A=·0025	A=·0050	A=·0100
2 Cyl.	1 Cyl.	·210	·220	·240
3 „	—	·225	·234	·252
4 „	2 „	·239	·248	·263
6 „	3 „	·268	·272	·284
8 „	4 „	·289	·290	·298
12 „	6 „	·334	·335	·338

TABLE VIII.

For Heavy Oil Engines in which the maximum pressure is 300 lbs. per square inch.

4 Cycle Single Acting Engines.	2 Cycle Single Acting Engines.	Values of the Co-efficient where		
		A=·0025	A=·0050	A=·0100
2 Cyl.	1 Cyl.	·230	·245	·260
3 „	—	·243	·255	·268
4 „	2 „	·255	·265	·275
6 „	3 „	·272	·280	·287
8 „	4 „	·290	·295	·299
12 „	6 „	·335	·338	·339

TABLE IX.

For Heavy Oil Engines in which the maximum pressure is 450 lbs. per square inch :—

4 Cycle Single Acting Engines.	2 Cycle Single Acting Engines.	Values of the Co-efficient where		
		A=·0025	A=·0050	A=·0100
2 Cyl.	1 Cyl.	·230	·252	·289
3 „	—	·245	·264	·294
4 „	2 „	·259	·275	·299
6 „	3 „	·279	·291	·307
8 „	4 „	·303	·309	·315
12 „	6 „	·351	·355	·358

TABLE X.

For Heavy Oil Engines in which the maximum pressure is 550 lbs. per square inch :—

4 Cycle Single Acting Engines.	2 Cycle Single Acting Engines.	Values of the Co-efficient where		
		A=·0025	A=·0050	A=·0100
2 Cyl.	1 Cyl.	·230	·255	·305
3 „	—	·245	·268	·309
4 „	2 „	·260	·280	·312
6 „	3 „	·283	·296	·318
8 „	4 „	·310	·316	·323
12 „	6 „	·360	·364	·368

In using the above tables the appropriate value of **A** is found from

$$A \times W \times d^2 \times R^2 = D^2 \times S$$

where **D** = diameter of cylinder in inches,
S = stroke of piston in inches,
d = diameter of fly wheel in feet,
R = revolutions of engines per minute,
W = total weight of fly wheel in tons.

6. If a separate fly wheel shaft is fitted its diameter must be at least equal to that of the crank shaft.

7. Where ordinary deep collars are used the diameter of the thrust shaft measured under the collars must be at least $\frac{21}{20}$ ths of that of the intermediate shaft. The diameter may be tapered off at each end to the same size as that of the intermediate shaft.

8. The diameter of the screw shaft must not be less than the diameter of the intermediate shaft (found as above) multiplied by $\left(\cdot 63 + \frac{\cdot 03\ P}{T}\right)$, but in no case must it be less than $1 \cdot 07\ T$

Where **P** = the diameter of the propeller in inches or millimetres,

T = the diameter of the intermediate shaft in inches or millimetres.

This size of screw shaft is intended to apply to shafts fitted with continuous liners the whole length of the stern tube, as provided for in Section 11, Clause 3 (Rules for Engines and Boilers of Steam Vessels). If no liners are used, or if two separate liners are used, the diameter of the shaft should be $\frac{21}{20}$ ths that given above.

The diameter of the screw shaft is to be tapered off at the forward end to the size of the thrust shaft.

71, Fenchurch Street, London, E.C. (3)
21*st April*, 1921.

FUEL TANKS AND CONNECTIONS.

Section 4. 1. All fuel tanks and their fittings are to be in accordance with Section 49 (Rules for Steel Ships).

2. Strong and readily removable metallic gauze diaphragms should be fitted at all openings on petrol tanks.

3. No glass gauges are to be fitted to fuel tanks containing either petrol or paraffin oil.

4. Filling pipes are to be carried through the deck so that the gas displaced from the tanks has free escape to the atmosphere.

5. Separate fuel tanks should be provided with metal or lined trays to prevent any possible leakage from them flowing into the bilges, or saturating woodwork. Arrangements are to be provided for emptying the tanks and draining the trays beneath them. For petrol tanks the trays must have drains leading overboard where possible or they should be gauze-covered trays with means for draining them.

6. All petrol or paraffin oil pipes are to be of annealed seamless copper with flexible bends. Their joints are to be conical, metal to metal. A cock or valve is to be fitted at each end of the pipe conveying the fuel from the tank to the carburettor or vaporizer. The fuel pipes should be led in positions where they are protected from mechanical injury and can be exposed to view throughout their whole length.

7. The engine room, and the compartment in which the fuel tanks are situated, are to be efficiently ventilated.

8. An approved fire extinguishing apparatus must be supplied.

PERIODICAL SURVEYS.

Section 5. 1. The machinery is to be submitted to survey annually. At these surveys the cylinders, pistons, connecting rods, crank and other shafts, inlet and exhaust valves and gear, clutches, reversing gear, propeller, sea connections, and pumps are to be examined. The electric ignition is to be examined and the electric leads tested. The separate fuel tanks and all connections are to be examined, and if deemed necessary by the Surveyor, to be tested to the same pressure as required when new. If practicable, the engines should be tested under working conditions.

2. The screw shaft is to be examined annually and drawn at intervals as provided for in Section 37, Clause 3 (Rules for Engines and Boilers of Steam Vessels).

By order of the Committee,
ANDREW SCOTT,
Secretary.

RULES FOR THE CONSTRUCTION AND SURVEY OF DIESEL ENGINES AND THEIR AUXILIARIES.

Section 1. In vessels propelled by Diesel Oil Engines, the Rules as regards machinery will be the same as those relating to steam engines, so far as regards the testing of material used in their construction and the fitting of sea connections, discharge pipes, shafting, stern tubes, and propellers.

CONSTRUCTION.

Section 2. 1. In vessels built under Special Survey and fitted with Diesel Engines, the engines must also be constructed under Special Survey.

2. In cases of Diesel Engines being built under Special Survey, the distinguishing mark ✠ will be noted in Red, thus :—✠LMC or ✠NE.

3. In order to facilitate the inspection, the plans of the machinery are to be examined by the Surveyors, and the dimensions of the shafts are to be submitted for approval.

4. The Surveyors are to examine the materials and workmanship from the commencement of the work until the final test of the machinery under full power working conditions ; any defects are to be pointed out as early as possible.

5. Any novelty in the construction of the machinery is to be reported to the Committee and submitted for approval.

6. The auxiliary engines used for air compressing, working dynamos and ballast, or other, pumps, are also to be surveyed during construction.

7. In cases where the designed maximum pressure in the cylinders does not exceed 500 lbs. per square inch, the diameters of the crank shaft of the main engines are not to be less than those given by the following formula :—

$$\text{Diameter of crank shaft} = \sqrt[3]{D^2 \times (AS + BL)}$$

where D = diameter of cylinder,
S = length of stroke,
L = span of bearings adjacent to a crank, measured from inner edge to inner edge.

The values of $(AS + BL)$ are as given in the following table :—

TABLE I.

4 Cycle Single Acting Engine.	2 Cycle Single Acting Engine.	Values of the Co-efficients.
4 or 6 cyls.	2 or 3 cyls.	$\cdot 089S + \cdot 056L$
8 cyls.	4 cyls.	$\cdot 099S + \cdot 054L$
10 or 12 cyls.	5 or 6 cyls.	$\cdot 111S + \cdot 052L$
16 cyls.	8 cyls.	$\cdot 131S + \cdot 050L$

For auxiliary engines of the Diesel Type the diameters of the crankshafts may be five per cent. less than given by the foregoing formula.

8. In solid forged shafts the breadth of the webs should be not less than 1·33 times and the thickness not less than 0·56 times the diameter of the shaft as found above, or, if these proportions are departed from, the webs must be of equivalent strength.

9. The diameter of the intermediate shaft must not be less than that given by the formula :—

$$\text{Diameter of intermediate shaft} \ldots = C \sqrt[3]{D^2 \times S}$$

where D = the diameter of cylinder,
S = the stroke of piston,
C is a co-efficient found from the following table by interpolation from the values found for A.

Where the stroke is not less than 1·2 times, nor more than 1·6 times the diameter of the cylinder, (·735 **D** + ·273 **S**) may be taken instead of $\sqrt[3]{\mathbf{D}^2 \times \mathbf{S}}$

TABLE II.

2 Cycle Single Acting Engines.	Values of the Co-efficient C where		
	A = ·0025	A = ·0050	A = ·0100
2 Cyls.	·305	·317	·336
3 „	·346	·363	·385
4 „	·364	·380	·396
5 „	·380	·391	·404
6 „	·398	·403	·412
4 Cycle Single Acting Engines.	**Values of the Co-efficient C where**		
	A = ·0025	A = ·0050	A = ·0100
4 Cyls.	·300	·312	·327
6 „	·338	·355	·370
8 „	·357	·366	·376
10 „	·376	·382	·389
12 „	·394	·398	·404

In using the above table the appropriate value of **A** is found from

$$\mathbf{A} \times \mathbf{W} \times d^2 \times \mathbf{R}^2 = \mathbf{D}^2 \times \mathbf{S}$$

where **D** = diameter of cylinder in inches,
S = stroke of piston in inches,
d = diameter of fly wheel in feet,
R = revolutions of engines per minute,
W = total weight of fly wheel in tons.

10. The diameter of the fly wheel shaft must be at least equal to that of the crank shaft.

11. Where ordinary deep collars are used the diameter of the thrust shaft measured under the collars must be at least $\frac{21}{20}$ths that of the intermediate shaft. The diameter may be tapered off at each end to the same size as that of the intermediate shaft.

12. The diameter of the screw shaft must be not less than the diameter of the intermediate shaft (found as above) multiplied by $\left(\cdot 63 + \frac{\cdot 03\,\mathbf{P}}{\mathbf{T}}\right)$, but in no case must it be less than 1·07 **T**,

where **P** = the diameter of the propeller in inches,
T = the diameter of intermediate shaft in inches.

The size of the screw shaft is intended to apply to shafts fitted with continuous liners the whole length of the stern tube, as provided for in Section 11, paragraph 3, of the Rules for Engines and Boilers of Steam Vessels. If no liners are used, or if two separate liners are used, the diameter of the screw shaft should be $\frac{21}{20}$ths that given above.

The diameter of the screw shaft is to be tapered off at the forward end to the size of the thrust shaft.

13. If the designed maximum pressure in the cylinders exceeds 500 lbs. per sq. inch, the diameters of the shafting throughout must be increased in the proportion of $\sqrt[3]{\frac{\text{maximum pressure in lbs. per sq. inch.}}{500}}$

14. Where the cylinder liners are made of hard close grained cast iron of plain cylindrical form, accurately turned on the outside as well as bored on the inside so that their soundness can be ascertained by inspection, and their thickness at the upper part is not less than $\frac{1}{15}$th of the diameter of the cylinder, they need not be hydraulically tested by internal pressure. If, however, they are made of complicated form, the question of testing must be submitted.

15. The water jackets of the cylinders, and the water passages of the cylinder covers and pistons, must be tested by hydraulic pressure to 30 lbs. per square inch, and must be perfectly tight at that pressure.

16. The exhaust pipes and silencers must be water-cooled or lagged by non-conducting material, where risk of damage by heat is likely to occur.

17. The cylinders are to be fitted with safety valves loaded to not more than 40 per cent. above the designed maximum pressure in the cylinders and discharging where no damage can occur.

18. The air compressors and their coolers are to be so made as to be easy of access for overhaul and adjustment.

19. Where the fuel is injected into the cylinders by air pressure, the following conditions are to be observed :—

In single screw vessels, an auxiliary air compressor is to be provided of sufficient power to enable the main engines to be kept continuously at work when the main compressor is out of action.

If the manœuvring gear is arranged so that the engines can be kept continuously at work with some of the cylinders out of action, the auxiliary compressor need only be of sufficient power to enable the engines to be kept at work under these conditions.

In twin screw vessels in which two sets of compressors are fitted, the auxiliary compressor must be of such size as to enable it to take the place of either of the main compressors. If in such engines each main compressor is sufficiently large to supply both engines, a smaller auxiliary compressor will be sufficient.

20. A small auxiliary compressor, worked by a steam engine, or by an oil engine not requiring compressed air, is to be fitted for first charging the air receivers.

21. At least one high pressure air receiver is to be arranged with connections to enable it to be used for fuel injection, in case the working receiver of either main engine is out of use from any cause.

22. The circulating pump sea suction is to be provided with an efficient strainer which can be cleared inside the vessel.

23. In all vessels fitted with engines in which the lubricating oil is circulated under pressure a spare oil pump is to be supplied with all connections ready for immediate use, and two independent means are to be arranged for circulating water through the oil cooler.

AIR RECEIVERS AND PIPES.

Section 3. 1. Compressed air receivers for starting air are to be supplied of sufficient capacity to permit of twelve consecutive startings of the engines without replenishment.

2. Cylindrical receivers for containing air under high pressure, used either for starting or for the injection of fuel in oil engines, may be made either of seamless steel or of welded, or riveted, steel plates.

3. **Quality of Material.**—If made of welded, or riveted, steel plates, the ordinary rules regarding steel material for boilers apply, which provide that where welding is employed, either in the longitudinal seams or at the ends, the material must have a tensile strength not exceeding 30 tons per square inch (Section 33, par. 7, Rules for Engines and Boilers of Steam Vessels). In these cases the welding must be lap welding; neither oxy-acetylene nor electric welding will be permitted.

4. In the case of seamless receivers, the rules for material will be the same as for boiler shells, but the permissible extension may be 2 per cent. less than that required with boiler plates.

5. **Tensile and Bend Tests** are to be made from the material of **each** receiver. When they are welded or riveted, the tests may be made, and the thicknesses verified, before the plates are bent into cylindrical form. In the cases of seamless receivers, the thicknesses must be verified by the Surveyor before the ends are closed in, and at this time the Surveyor shall select and mark the test pieces required from either of the open ends of the tube. The test pieces are to be annealed before test, so as to properly represent the finished material.

6. The permissible working pressure for welded or seamless receivers is to be determined by the following formulæ:—

Maximum working pressure in lbs. per sq. inch

$$= \frac{C \times S \times (T - 2)}{D}$$

for thicknesses of $\frac{5}{8}$ in. and above,

$$= \frac{C \times S \times (T - 1)}{D}$$

for thicknesses below $\frac{5}{8}$ in.,

where S = Minimum tensile strength of the steel material used, in tons per sq. inch,

T = Thickness of the material, in sixteenths of an inch,

D = Internal diameter of cylinder, in inches,

C = Co-efficient as per following table:—

Co-efficient	
77	for seamless receivers of thickness of $\frac{5}{8}$ in. and above,
69	for seamless receivers of thickness below $\frac{5}{8}$ in.
54	for welded receivers of thickness of $\frac{5}{8}$ in. and above,
48	for welded receivers of thickness below $\frac{5}{8}$ in.

7. For flat ends welded into the cylindrical shells, the thickness must not be less than

$$T = \frac{D}{17} \times \sqrt{P}$$

where T = thickness, in sixteenths of an inch,

D = internal diameter, in inches,

P = working pressure, in lbs. per square inch.

8. The permissible working pressure for receivers made of riveted steel plates is to be determined by the rules regulating the working pressure of boilers.

9. Each welded or seamless receiver shall be carefully annealed after manufacture, and before the hydraulic test.

10. Each welded or seamless receiver shall be subjected to a hydraulic test of twice the working pressure, which it shall withstand without permanent set.

11. Each receiver made of riveted steel plates for pressures up to 300lbs. per sq. inch is to be tested by hydraulic pressure to 1½ times the working pressure, plus 50 lbs. per sq. inch. Where higher working pressures are used, the test pressure need not be more than 200lbs. per sq. inch above the working pressure.

12. All receivers above six inches internal diameter must be so made that the internal surfaces may be examined, and, wherever practicable, the openings for this purpose should be sufficiently large for access. Means must be provided for cleaning the inner surfaces by steam, or otherwise.

13. Each receiver which can be isolated must have a safety valve fitted, adjusted to the maximum working pressure. If, however, the air compressor is fitted with a safety valve so arranged and adjusted that no greater pressure than that permitted can be admitted to the receivers, they need not be fitted with safety valves.

14. Each receiver must be fitted with a drain arrangement at its lowest part, permitting oil and condensed water to be blown out.

15. Oil or air pipes subjected to high pressure are to comply with the Rules for steam pipes, Section 13, Clauses 7 and 16 (Rules for Engines and Boilers of Steam Vessels).

Pipes which are subjected to a working pressure up to 1,000 lbs. per square inch must be tested hydraulically to at least twice the working pressure to which they will be subjected, and those subjected to a higher working pressure than 1,000 lbs. per square inch to an hydraulic test of at least 1,000 lbs. per square inch above their working pressure.

PUMPING ARRANGEMENTS.

Section 4. The pumping arrangements are to be the same as would be required for steam vessels of similar size and power, with the exception that no bilge suction need be fitted to the main engine circulating pump. In the cases of vessels fitted with water ballast, the water ballast pump must have, in addition, one direct suction from the engine room bilges.

GENERAL.

Section 5. 1. All oil fuel pipes, tanks and their fittings must comply with the requirements of Section 49 (Rules for Steel Ships).

2. Special attention must be given to the ventilation of the engine room.

3. If the auxiliaries are worked by electricity, the cables in connection with them must be in accordance with the rules for electric fittings.

4. It is recommended that all pipes conveying fuel oil should, as far as possible, be made of steel or iron, rather than copper, owing to the rapid corrosion of copper pipes when using oil containing sulphur.

SPARE GEAR.

Section 6. The articles mentioned in the following list will be required to be carried, viz. :—

1 cylinder cover complete for the main engines, with all valves, valve seats, springs, etc., fitted to it.

In addition, one complete set of valves, valve seats, springs, etc., for one cylinder of the main and of the auxiliary Diesel engines, and fuel needle valves for half the number of cylinders of each engine.

1 piston complete, with all piston rings, studs, and nuts for the main engines.

In addition, one set of piston rings for one piston of the main and of the auxiliary Diesel engines.

1 complete set of main skew wheels for one main engine.

2 connecting rod, or piston rod, top-end bolts and nuts, both for the main and for the auxiliary Diesel engines.

2 connecting rod bottom end bolts and nuts, both for the main and for the auxiliary Diesel engines.

2 main bearing bolts and nuts, both for the main and for the auxiliary Diesel engines.

1 set of coupling bolts for the crank shaft.

1 set of coupling bolts for the intermediate shaft.

1 complete set of piston rings for each piston of the main and of the auxiliary compressors.

1 half set of valves for the main and for the auxiliary compressors.

1 fuel pump complete for the main engine, or a complete set of all the working parts.

1 fuel pump for the auxiliary Diesel engine, or a complete set of all working parts.

1 set of valves for the daily fuel supply pump.

1 set of valves for the water circulating pumps.

1 set of valves for one bilge pump.

1 set of valves for the scavenge pump, where lift valves are used.

1 set of valves for the lubricating oil pump.

1 bucket and rod for the lubricating oil pump.

A quantity of assorted bolts and nuts, including one set of cylinder cover studs and nuts.

Lengths of pipes suitable for the fuel delivery and the blast pipes to the cylinders, and the air delivery from the compressors to the receivers, with unions and flanges suitable for each.

PERIODICAL SURVEYS.

Section 7. 1. The engines are to be submitted to survey annually, and in addition are to be submitted to a Special Survey upon the occasion of the vessels undergoing the Special Periodical Surveys Nos. 1, 2, and 3 prescribed in the Rules, unless the machinery has been specially surveyed within a period of twelve months, in which case the Annual Survey will be sufficient. The boilers, if fitted, are to be subjected to the same surveys as required by Section 37 of the Rules for Engines and Boilers of Steam Vessels.

2. **Special Surveys.**—At these special surveys, the main engines and the auxiliary engines are to be examined throughout, viz.:—All the cylinders, pistons, valves and valve gears, connecting rods and guides, pumps, crank, intermediate, and thrust shafts, propellers, stern bushes, sea connections and their fastenings, are to be examined. The air compressors are also to be examined. The air receivers are to be cleaned and examined and, if necessary, tested, as provided for in paragraph 3 of this Section.

3. **Annual Surveys.**—The whole of the parts of the engines which the engineers of the vessel open up for adjustment and overhaul should be examined and reported upon. The Survey must include, for each main engine, the examination of at least 2 pistons, 2 cylinder covers and their valves, 2 connecting rods and their brasses, both top and bottom ends, 2 of the main bearings and crank shaft journals, and 1 of the tunnel bearings. If these are all satisfactory, their condition may be taken as representing that of the other similar parts.

In the auxiliary Diesel engines, a similar course must be adopted, but in this case one of each of the parts mentioned of each engine will be sufficient, if found to be satisfactory.

The valve gears of all the Diesel engines should be examined, as far as practicable, without complete dismantling.

The air receivers must be examined internally if possible, and, together with the air pipes from the compressors, must be cleaned internally by means of steam, or otherwise. If the air receivers cannot be examined internally, they must be tested by hydraulic pressure to twice the working pressure at each alternate Annual Survey, attention being specially given to the welding of the ends and of the longitudinal joints.

The pumps and air compressors must be examined and tried under working conditions. If found to be satisfactory, they need not be dismantled.

The manœuvring of the engines must be tested under working conditions.

If the examination reveals any defects, the Surveyor should recommend such further opening up as he may consider to be necessary.

4. **Record of Survey.**—If the various parts mentioned in paragraphs 2 or 3 are all found to be in a satisfactory condition and the Surveyor finds that the machinery generally is in good order, he should recommend the vessel to have a fresh record of LMC.

5. **Survey of Screw Shafts.**—The screw shaft is to be examined annually and drawn at intervals as provided for in Section 37, Clause 3 (Rules for Engines and Boilers of Steam Vessels).

71, Fenchurch Street, London, E.C. 3.
21*st April*, 1921.

By order of the Committee,
ANDREW SCOTT,
Secretary.

RULES FOR ELECTRIC FITTINGS ON BOARD VESSELS.

GENERAL.

In cases in which electricity is used on board classed vessels for purposes other than propulsion of the ship, the following Rules should be observed.

NATURE OF SUPPLY.

1. **Standard Systems.**—The following systems of distribution may be used—

A. Single wire with Hull return.

B. Two-wire with direct or single-phase alternating current.

C. Three-wire with direct current.

D. Three-phase three-wire.

E. Three-phase four-wire.

2. **Limiting Pressures.**—The pressure of supply should not exceed the following values :—

With direct current for power, heating or lighting, 250 volts.

With alternating current for power and heating, 250 volts ; for lighting, 150 volts.

GENERATING PLANT.

1. **Generators.**—Generators shall be capable of sustaining an overload of 25 per cent for 2 hours. The temperature rise at rated full load shall not exceed 72 degrees F.

Generators shall be compound wound unless arranged to run in parallel and at such distances apart as to render the amount of copper in the equalizing conductors excessive, in which case they may be shunt wound.

Generators shall, unless otherwise specified, be over-compounded 5 per cent under conditions of constant speed and excitation.

2. When generators are run in parallel each shall be fitted with an adjustable regulating resistance in series with its shunt field, to vary the pressure of the generator between 5 per cent above, and 10 per cent below the normal at any load, and there shall not be less than 25 equal steps of resistance.

3. Suitable terminals, clearly marked, shall be provided in an accessible position convenient for wiring, and they shall be furnished with appropriate cable sweating sockets.

They shall be so spaced and/or shielded that they cannot be accidentally earthed, short-circuited, or touched.

4. Generators shall be efficiently and continuously lubricated automatically with the base of the machine inclined at any angle up to 15 degrees from the horizontal in any and every direction.

If ring lubrication be employed, the rings shall be so constrained that they cannot leave the shaft.

Oil flingers, or other suitable means, shall be provided to prevent the lubricant from creeping along the shaft, or otherwise gaining access to the insulation of the machine or any live part thereof.

5. **Position in Ship.**—The generators shall be placed in a well-ventilated compartment in which inflammable gases cannot accumulate, and in such a position as to be clear of all inflammable material. No unprotected woodwork or other combustible material shall be within a distance of 12 inches measured horizontally from, or within 4 feet measured vertically above, the generators.

They shall be placed in positions in which they are not exposed to risk of mechanical injury or to damage from water, steam or oil, and in all sea-going ships they shall be placed with their axes of rotation in a fore and aft direction.

6. **Plant to be Earthed.**—The bedplate and frame of the generating plant shall be efficiently earthed, and no

insulation shall be interposed between the prime mover and the generator.

SWITCHBOARDS.

1. **Position.**—Switchboards shall be placed in accessible positions, free from inflammable gases and acid fumes, in which they are not exposed to risk of mechanical injury or to damage from water, steam or oil.

No unprotected woodwork or other combustible material shall be within a distance of 12 inches of any live metal measured horizontally from, or within 4 feet measured vertically above, the switchboard.

2. **General Construction.**—Switchboards shall be constructed wholly of durable, incombustible, non-absorbent materials, and all insulation shall be of permanently high insulation resistance.

If semi-insulating materials such as marble or slate be used, all conducting parts connected to one pole shall be insulated from the slate or marble slab with mica or micanite, and the slab shall be similarly insulated as a whole from the frame on which it is mounted; the frame shall be effectually earthed. It is recommended that wooden frames should not be fitted to switchboards.

The various live parts shall be so arranged, by suitable spacing or shielding with incombustible insulating materials, that an arc cannot be maintained between any such parts.

All parts, including connections, shall be readily accessible from the front or back. No fuse shall be placed at the back of the board.

Omnibus bars and ordinary connecting conductors on switchboards shall be so proportioned that their average temperature shall not rise more than 54 degrees F. above that of the surrounding air when the maximum current flows through them continuously, provided that the temperature rise of no part exceeds the average temperature by 9 degrees F.

Every voltmeter, pilot or earth lamp, with its connecting wires, shall be protected individually by a fuse on each insulated pole.

Switches shall be so connected to omnibus bars that their blades or moving parts are not alive in the off position.

In every case in which switches and fuses are fitted on the same pole, these switches shall be connected between the fuses and the omnibus bars of the switchboard.

In every case in which single-pole switches or fuse-switches are required by these regulations, they shall be fitted on the same pole throughout the installation.

In every case in which a separate fuse and switch or separate fuses and linked switches are required by these regulations, they may be replaced by a fuse-switch or linked fuse-switches.

3. **Main Switchgear.**—Every main switchboard shall be fitted with the following switchgear as a minimum.

I. Two-wire Systems.

When only one generator is installed: For the Generator :—

(i) Either a single-pole overload circuit breaker or a single-pole fuse and a single-pole switch on the insulated pole in a single-conductor or a two-conductor earthed system.

(ii) Either a double-pole overload circuit breaker or a fuse on each pole and a double-pole linked switch in a two-conductor insulated system.

For each Outgoing Circuit :—

(i) A single-pole fuse and a single-pole switch on the insulated pole in a single-conductor or a two-conductor earthed system.

(ii) A fuse on each pole and a single-pole switch on one pole in a two-conductor insulated system.

When more than one generator is installed, the generators not being arranged to run in parallel :

For each Generator :—

(i) Either a single-pole overload circuit breaker, or a single-pole fuse and a single-pole switch, on the insulated pole in a single-conductor or a two-conductor earthed system.

(ii) Either a double-pole overload circuit breaker, or a fuse on each pole and a double-pole linked switch in a two-conductor insulated system.

For each Outgoing Circuit :—

(i) A single-pole fuse and a single-pole change-over switch on the insulated pole in a single-conductor or a two-conductor earthed system.

(ii) A fuse on each pole and a single-pole change-over switch on one pole, all such change-over switches being on the same pole in a two-conductor insulated system.

When more than one generator is installed, the generators being arranged to run in parallel :

For each generator, if shunt-wound, a circuit breaker with overload and reversed current trips, the circuit breaker to be :—

Single-pole in a single-conductor or a two-conductor earthed system and double-pole in a two-conductor insulated system.

For each generator, if compound-wound, a circuit breaker with overload and reversed-current trips, and a single-pole equalizer switch so interlocked with the circuit breaker that this equalizer switch must be closed before the circuit breaker, and cannot be opened until the main circuit is broken. This circuit breaker to be :—

Single-pole in a single-conductor or a two-conductor earthed system and double-pole in a two-conductor insulated system.

For each Outgoing Circuit :—

(i) A single-pole fuse and switch on the insulated pole in a single-conductor or a two-conductor earthed system.

(ii) A fuse on each pole and a single-pole switch on one pole in a two-conductor insulated system.

II. Three-wire Systems.

When more than one generator is installed, the generators being arranged to run in parallel, whether the machines are wound for the full pressure or for half pressure and act as balancers :—

For each generator, if shunt-wound, a double-pole circuit breaker with overload and reversed current trips.

For each generator, if compound-wound, a double-poll circuit breaker with overload and reversed-current trips, and a single-pole equalizer switch so interlocked with the circuit breaker that this equalizer switch must be closed before the circuit breaker, and cannot be opened until the main circuit is broken.

For each outgoing three-wire circuit where the supply is given to three conductors, either a double-pole overload circuit-breaker controlling the outer conductors, or a fuse on each outer conductor and a double-pole linked switch controlling the outer conductors. A fuse or switch shall not be included in the neutral conductor, but this requirement does not preclude the provision of an isolating link for testing purposes.

For each outgoing two-conductor insulated circuit from the neutral and one outer of a three-wire system either a double-pole overload circuit-breaker, or a double-pole linked switch with a fuse on each pole.

For each outgoing single-conductor or two-conductor earthed circuit from the neutral and an outer of a three-wire system, either a double-pole circuit breaker with overload trip on that pole which is connected to the outer conductor, or a single-pole fuse on that pole which is connected to the outer conductor and a double-pole linked switch.

III. Three-phase Three-wire Systems.

For each generator a triple-pole circuit-breaker with overload trips on at least two phases.

For each outgoing three-conductor circuit to which a supply is given from the three conductors, either a triple-pole circuit breaker with overload trips on at least two phases, or a triple-pole linked switch with a fuse on each pole.

For each outgoing two-wire circuit to which a supply is given from any two of the three conductors, either a double-pole overload circuit breaker, or a double-pole linked switch with a fuse on each pole.

IV. Three-phase Four-wire Systems.

For each generator a triple-pole circuit breaker with an overload trip on each phase.

For each outgoing three-conductor circuit to which a supply is given from the three conductors, either a triple-pole circuit breaker with overload trips on at least two phases, or a triple-pole linked switch with a fuse on each pole.

For each outgoing two-wire circuit to which a supply is given from one of the three conductors and the neutral, either a single-pole overload circuit-breaker, or a single-pole switch and single-pole fuse.

For each outgoing four-wire circuit used to supply a distribution switchboard from which three-wire or two-wire circuits radiate, either a triple-pole circuit breaker with an overload trip on each phase, or a triple-pole linked switch with a fuse on each pole. A fuse or switch shall not be included in the neutral conductor, but this requirement does not preclude the provision of an isolating link for testing purposes.

4. **Instruments.**—Every main switchboard shall be provided with the following instruments as a minimum :—

(*a*) *Two-wire Systems.*

When only one generator is installed, one ammeter and one voltmeter.

When more than one generator is installed, the generators not being arranged to run in parallel, an ammeter for each generator and one voltmeter, for use on any generator, fitted with a linked double-pole multiple-way switch or plug.

When more than one generator is installed, the generators being arranged to run in parallel, an ammeter for each generator, and two voltmeters; also a synchronizing device for paralleling purposes if the current be alternating.

For compound machines the ammeter shall be connected on the opposite pole from that to which the equalizer connection is made.

One of these voltmeters shall be fitted with a linked double-pole multiple-way switch or plug enabling it to be connected to any one generator before the machine is put in circuit; the other voltmeter shall be permanently connected to the omnibus bars.

(*b*) *Three-wire Systems.*

In addition to the instruments required for two-wire systems a voltmeter shall be connected between the neutral and each outer omnibus bar; also a central zero ammeter in the main neutral conductor.

(*c*) *Three-phase Systems.*

When only one generator is installed, an ammeter on each phase, and one voltmeter.

When more than one generator is installed, the generators being arranged to run in parallel, an ammeter on each phase for each generator, two voltmeters and a synchronizing device for paralleling purposes. One of these voltmeters shall be fitted with a linked double-pole multiple-way switch or plug enabling it to be connected to one phase of any one generator before the machine is put in circuit. The other voltmeter shall be permanently connected to one phase of the omnibus bars. All these voltmeter connections shall be made to the same phase in each case.

Every voltmeter shall be protected by a fuse on each insulated pole.

5. **Earth Testing.**—Main switchboards shall be provided with suitable means for indicating the state of the insulation of the system, either by lamps, voltmeters, or otherwise, unless one pole be permanently earthed.

6. **Switches and Circuit Breakers.**—Every switch, fuse-switch, and other circuit breaker shall comply with the following requirements:—

All parts shall be so proportioned that their temperature shall not rise more than 54 degrees F. above that of the surrounding air when the normal working current for which they are designed flows through them continuously.

Each fuse-switch when opening the circuit as a switch, and each switch, shall break the circuit without permitting an arc to be maintained when a current 50 per cent. greater than that for which it is rated is flowing under a pressure 50 per cent. in excess of the pressure of supply. Each fuse-switch when opening the circuit as a fuse, and each circuit breaker, shall comply with the Rule for fusible cut-outs.

Every circuit-opening device shall be so constructed and arranged that when placed in the off position it cannot accidentally move sufficiently to close the circuit.

The handles and their attachments shall be mechanically strong, and the exposed surface shall consist entirely of insulating material. They shall be so designed that the hand of the operator cannot accidentally touch live metal or be injured through an adjacent fuse blowing. They shall not operate through open slotted holes.

The bases shall be of durable, incombustible, insulating, non-absorbent material.

When switches are not fixed on a switchboard, the live parts shall be enclosed by covers of incombustible material. In positions in which they are liable to mechanical injury these shall be of rigid metal or protected by a suitable guard. In other positions the covers may be either of rigid metal or non-conducting material. Metal cases shall be well clear of live parts, and when the switches are rated for currents exceeding 6 amperes at pressures exceeding 125 volts they shall be lined with incombustible insulating material.

All switches fixed in positions exposed to the weather, to drip, or to an excessively moist atmosphere, shall be contained in watertight cases.

Every electro-magnetic circuit breaker shall be provided with suitable means of adjustment for determining the current at which it shall open, and shall be so arranged that it cannot be held in against this current. It shall

further be provided with a retarder for delaying its operation for a period approximately in inverse proportion to the overload.

7. **Fusible Cut-outs.**—Every cut-out shall comply with the following requirements :—

All parts other than the fusible metal shall be so proportioned that their temperature shall not rise more than 54 degrees F. above that of the surrounding air when the normal working current for which they are designed flows through them continuously.

The fusing current of the fuse shall be three times the normal working current of the circuit it controls, when such current is between 3 amperes and 10 amperes, and twice the normal working current for larger currents.

Every cut-out shall be provided with a suitable incombustible and insulating carrier for the fuse, of such form as to protect a person handling it from shock and burns.

Contacts shall be provided on the carrier to which the ends of the fuse can be readily attached.

The circuit contacts and their terminals shall be so spaced or shielded that an arc cannot be maintained when a fuse is blown.

Fuses shall not be placed in switches, wall plugs, sockets, or in ceiling roses.

When cut-outs are not fixed on a switchboard they shall be grouped on section or distribution boards, or shall be contained within cases conforming in all respects to the requirements laid down in the following Rule.

8. **Section and Distribution Boards.**—Section and Distribution Boards shall be constructed in accordance with the Rule for Main Switch-boards.

Every section or distribution board shall be contained within a protecting case, unless of such size that they are contained in separate compartments or spaces in the ship.

All metal cases shall be lined with incombustible insulating shields opposite switches and fuses, whether such fuses are of the enclosed or open type, and all live parts therein shall not be less than $1\frac{1}{2}$ inches clear of the case.

All wooden cases shall be lined with incombustible material, which shall clear all live parts by not less than one inch.

Boxes not provided with backs forming an integral portion thereof shall have an incombustible insulating shield between their contents and the bulkhead, or any other structure, to which they are fixed.

All cases fixed in positions exposed to the weather, to drip, or to an excessively moist atmosphere, shall be watertight.

CONDUCTORS.

1. **Material.**—All conductors shall be of annealed copper conforming to British Standard Specification No. 7.

When the insulating covering of the conductor contains sulphur each wire shall be efficiently and uniformly coated with tin free from all impurities. In the case of flexible cords alternative means of protecting the copper may be used provided that it be equally effectual.

2. **Minimum Size of Conductor.**—No cable having a conductor of less sectional area than 0·0015 square inch shall be used except for wiring ornamental fittings which cannot admit this cable; the sectional area of the conductor of the cable for such fittings shall not be less than 0·001 square inch.

3. **Maximum Size of Single Wire.**—All conductors having an effective sectional area exceeding 0·0033 square inch shall be stranded.

4. **Proportioning of Conductors to Current carried.**—It is recommended that the size of conductors shall be so selected that the fall of pressure between the main switchboard omnibus bars and any, and every, point of the installation when carrying the maximum load probable under the heaviest practical conditions of service shall not exceed 2 volts plus 3 per cent of the omnibus bar pressure for lighting and 2 volts plus 5 per cent of the omnibus bar pressure for power and heating circuits, provided that in no case shall the current exceed that given in Table I. for each size of conductor when this maximum current is being carried and that clause 2 be complied with.

5. **Standard Sizes.**—The sizes of conductor shown in Tables I. and II. are recognised as standard for ships' installations. These Tables show the maximum current that each size may carry when the length of conductor is such that the fall of pressure does not exceed that corresponding to the percentage limits laid down in clause 4. The Tables also show the total length of conductor in circuit that will give a drop of pressure of 1 volt when such maximum current is being carried. In Table I. allowance is made for the class of insulation with which the conductor is covered.

TABLE I.

CURRENT-CARRYING CAPACITY AND CORRESPONDING FALL OF PRESSURE—CABLES.

Nominal Area of Conductor.	Effective Area of Conductor.	Composition of Strand.	Insulated with Rubber.		Insulated with Paper.	
			Maximum Current.	Approx. Length (lead and return) giving 1 volt drop of pressure.	Maximum Current.	Approx. Length (lead and return) giving 1 volt drop of pressure.
1.	2.	3.	4.	5.	6.	7.
sq. in.	sq. in.	No. and diam.	amps.	ft.	amps.	ft.
0·0010	0·00102	1/·036	4·1	31	4·1	31
0·0015	0·00152	1/·044	6·1	31	6·1	31
0·0020	0·00194	3/·029	7·8	31	7·8	31
0·0030	0·00299	3/·036	12·0	31	12·0	31
0·0030	0·00322	1/·064	12·9	31	12·9	31
0·0045	0·00455	7/·029	18·2	31	18·2	31
0·0070	0·00701	7/·036	24·0	34	28·2	31
0·0100	0·01046	7/·044	31·0	39	42·0	31
0·0145	0·01462	7/·052	37·0	46	57·0	31
0·0225	0·02214	7/·064	46·0	56	75·0	33
0·0400	0·03960	19/·052	64·0	72	104·0	42
0·0600	0·06000	19/·064	83·0	84	135·0	49
0·0750	0·07592	19/·072	97·0	91	157·0	53
0·1000	0·10090	19/·083	118·0	99	191·0	58
0·1200	0·11680	37/·064	130·0	105	210·0	61
0·1500	0·14780	37/·072	152·0	114	246·0	66
0·2000	0·19640	37/·083	184·0	125	296·0	73
0·2500	0·24650	37/·093	214·0	135	343·0	79
0·3000	0·30240	37/·103	240·0	147	385·0	87
0·4000	0·40640	61/·093	288·0	165	464·0	97
0·5000	0·49850	61/·103	332·0	175	540·0	102
0·6000	0·60620	91/·093	384·0	184	624·0	107
0·7500	0·74350	91/·103	461·0	188	738·0	111
1·0000	1·03760	127/·103	595·0	204	932·0	123

TABLE II.

CURRENT-CARRYING CAPACITY AND CORRESPONDING FALL OF PRESSURE—FLEXIBLE CORDS.

Nominal Area of Conductor.	Composition of Strand.	Maximum Current Permissible.	Length (lead and return) giving 1 volt drop of pressure.
1.	2.	3.	4.
sq. in.	No. and diam.	amps.	ft.
0·0017	40/0·0076	3·5	61
0·0030	70/0·0076	6·5	58
0·0070	162/0·0076	12·0	73
0·0100	140/0·0100	15·0	87
0·0145	196/0·0100	18·0	101
0·0225	296/0·0100	23·0	120

INSULATION AND PROTECTIVE COVERING OF CABLES.

1. **Types of Cables.**—Only the following types of cables shall be employed, either single or twin :—

(a) Vulcanized rubber insulated.

(i) Braided.

(ii) Lead covered.

(iii) Lead covered and armoured (with or without braiding over the armour).

(iv) Braided and armoured (with or without braiding over the armour).

(b) Paper insulated.

(i) Lead covered.

(ii) Lead covered and armoured (with or without braiding over the armour).

2. **Vulcanized Rubber Insulated Cables.**—Vulcanized rubber insulated cables shall be insulated with a layer of pure rubber next to the conductor, an intermediate layer of vulcanizing rubber, and an outer jacket of vulcanizing rubber. These three layers shall together constitute the dielectric. The radial thickness of dielectric shall not be less than that specified in column 3 of Table III. The

TABLE III.

DIMENSIONS OF CABLES—RUBBER INSULATED.

Conductors.		Dielectric.	Braided Cables.	Braided and Armoured Cables.			Lead-covered Cables.		Lead-covered and Armoured Cables.		
Nominal Area.	Overall Diameter.	Thickness.	Overall Diameter.	Diameter of Armouring Wire.	Diameter over Armour.	Diameter over Armour and Braiding.	Thickness of Lead.	Diameter over Lead.	Diameter of Armouring Wire.	Diameter over Armour.	Diameter over Armour and Braiding.
1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.
sq. in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
0·0010	0·036	0·034	0·165	0·064	0·328	0·418	0·040	0·200	0·064	0·408	0·498
0·0015	0·044	0·034	0·173	0·064	0·336	0·426	0·040	0·208	0·064	0·416	0·506
0·0020	0·062	0·036	0·195	0·064	0·358	0·448	0·040	0·230	0·064	0·438	0·528
0·0030	0·078	0·038	0·215	0·064	0·378	0·468	0·040	0·250	0·064	0·458	0·548
0·0030	0·064	0·036	0·197	0·064	0·360	0·450	0·040	0·232	0·064	0·440	0·530
0·0045	0·087	0·039	0·226	0·064	0·389	0·479	0·040	0·261	0·064	0·469	0·559
0·0070	0·108	0·041	0·259	0·064	0·422	0·512	0·050	0·314	0·064	0·522	0·612
0·0100	0·132	0·043	0·287	0·064	0·450	0·540	0·050	0·342	0·064	0·550	0·640
0·0145	0·156	0·046	0·317	0·064	0·430	0·570	0·060	0·392	0·064	0·600	0·690
0·0225	0·192	0·049	0·359	0·064	0·522	0·612	0·060	0·434	0·072	0·698	0·788
0·0400	0·260	0·056	0·441	0·064	0·604	0·694	0·060	0·516	0·072	0·780	0·870
0·0600	0·320	0·062	0·513	0·072	0·732	0·822	0·070	0·608	0·072	0·872	0·962
0·0750	0·360	0·066	0·596	0·072	0·780	0·870	0·070	0·656	0·072	0·920	1·010
0·1000	0·415	0·072	0·663	0·072	0·847	0·937	0·070	0·723	0·072	0·987	1·077
0·1200	0·448	0·075	0·702	0·072	0·886	0·976	0·070	0·762	0·072	1·026	1·116
0·1500	0·504	0·080	0·768	0·072	0·952	1·042	0·080	0·848	0·080	1·208	1·298
0·2000	0·581	0·088	0·889	0·072	1·053	1·143	0·080	0·949	0·080	1·309	1·399
0·2500	0·651	0·095	0·973	0·080	1·233	1·353	0·090	1·053	0·104	1·461	1·581
0·3000	0·721	0·102	1·057	0·080	1·317	1·437	0·090	1·137	0·104	1·545	1·665
0·4000	0·837	0·114	1·197	0·104	1·505	1·625	0·100	1·297	0·104	1·705	1·825
0·5000	0·927	0·121	1·301	0·104	1·609	1·729	0·110	1·421	0·128	1·877	1·997
0·6000	1·023	0·125	1·425	0·128	1·761	1·881	0·110	1·525	0·128	1·981	2·101
0·7500	1·133	0·131	1·547	0·128	1·883	2·003	0·120	1·667	0·160	2·187	2·307
1·0000	1·339	0·141	1·773	0·128	2·173	2·293	0·120	1·893	0·160	2·413	2·533

dielectric shall be surrounded by a layer of waterproof tape, and the whole shall be vulcanized together.

Braided cables shall have an exterior braiding of hemp, cotton or jute thoroughly impregnated with a protective compound of such a nature as not to have any deleterious action on the rubber or armouring, as the case may be. The finish of the braiding shall be smooth and uniform.

3. **Paper-insulated Cables.** — Paper-insulated cables shall be insulated with a covering of paper impregnated with a chemically neutral insulating compound. This dielectric shall be such as to permit the cable to be bent to a radius of 10 times the diameter, measured over the lead covering, without damage, and the compound shall not ooze appreciably when the cable is cut.

The radial thickness of dielectric shall not be less than that specified in column 3 of Table IV.

Table IV.

Dimensions of Cables–Paper Insulated.

Conductors.		Di-electric.	Lead Covered Cables.		Armoured Cables.	
Nominal Area. 1.	Overall Diameter. 2.	Thickness. 3.	Thickness of Lead. 4.	Diameter over Lead. 5.	Diameter of armouring wire. 6.	Diameter over Armour. 7.
sq. in.	in.	in.	in.	in.	in.	in.
0·0010	0·036	0·050	0·045	0·226	0·064	0·434
0·0015	0·044	0·050	0·045	0·234	0·064	0·442
0·0020	0·062	0·050	0·045	0·252	0·064	0·460
0·0030	0·078	0·050	0·045	0·268	0·064	0·476
0·0030	0·064	0·050	0·045	0·254	0·064	0·462
0·0045	0·087	0·060	0·050	0·307	0·064	0·515
0·0070	0·108	0·080	0·060	0·388	0·064	0·596
0·0100	0·132	0·080	0·060	0·412	0·072	0·676
0·0145	0·156	0·080	0·060	0·436	0·072	0·700
0·0225	0·192	0·080	0·060	0·472	0·072	0·736
0·0400	0·260	0·080	0·060	0·540	0·072	0·804
0·0600	0·320	0·080	0·060	0·600	0·072	0·864
0·0750	0·360	0·080	0·070	0·660	0·072	0·924
0·1000	0·415	0·080	0·070	0·715	0·072	0·979
0·1200	0·448	0·080	0·070	0·748	0·072	1·012
0·1500	0·504	0·080	0·070	0·804	0·080	1·164
0·2000	0·581	0·080	0·070	0·881	0·080	1·241
0·2500	0·651	0·090	0·080	0·991	0·080	1·351
0·3000	0·721	0·090	0·080	1·061	0·104	1·469
0·4000	0·837	0·100	0·090	1·217	0·104	1·625
0·5000	0·927	0·100	0·090	1·307	0·128	1·763
0·6000	1·023	0·100	0·100	1·423	0·128	1·879
0·7500	1·133	0·110	0·100	1·553	0·128	2·009
1·0000	1·339	0·110	0·110	1·779	0·160	2·299

4. **Lead Covering.**—All cables when required to be lead covered shall be provided with a closely fitting sheath of pure lead of uniform thickness concentric with the conductor, free from flaws of all kinds and having a smooth exterior surface.

The radial thickness of lead shall not be less than that specified in column 8 of Table III. or column 4 of Table IV. according to the dielectric used.

5. **Armouring.**—Lead-covered cables when required to be armoured shall have over the lead a layer of jute yarn impregnated with a moisture-resisting preservative compound. On the jute shall be bedded an armouring of annealed and galvanized steel wire; each wire shall be of the diameter specified in column 10 of Table III. or column 6 of Table IV. The wires shall have a uniform lay not exceeding 10 times the diameter of their pitch circle for wires of 0·104 inch diameter, and not exceeding 8 times the pitch circle diameter for smaller wires. The armouring shall be so applied as to present a uniform cylindrical exterior surface, and the overall diameter shall not exceed that specified in column 11 of Table III. or column 7 of Table IV.

Braided cables armoured without the interposition of a lead covering shall conform to the above except that the armouring shall be bedded on the braiding.

6. **Tests of Dielectric of Cables.**—The dielectric shall be such that when the insulated conductor has been immersed in water for 24 hours it shall, while still immersed, withstand an alternating pressure of 1,000 volts for half an hour. The testing pressure shall have a frequency of from 25 to 100 periods per second and shall be derived from a source having a rated output of not less than 5 kilowatts.

The insulation resistance of rubber-insulated conductors at a temperature of 60° F., measured after the test above specified and whilst still immersed, shall not be less than

that given in Table V. for each size of conductor. The insulation resistance shall be measured after one minute's electrification at a pressure of not less than 500 volts.

TABLE V.

INSULATION RESISTANCE OF RUBBER INSULATED CABLES.

Nominal Area of Cable.	Minimum Insulation Resistance.	
	Megohms for a 1,000 yard length at 60° F. (15·6° C.)	Megohms for a mile length at 60° F. (15·6° C.)
sq. in.		
0·0010	3,520	2,000
0·0015	3,520	2,000
0·0020	2,200	1,250
0·0030	2,200	1,250
0·0030	3,520	2,000
0·0045	2,200	1,250
0·0070	1,584	900
0·0100	1,584	900
0·0145	1,584	900
0·0225	1,584	900
0·0400	1,320	750
0·0600	1,320	750
0·0750	1,056	600
0·1000	1,056	600
0·1200	1,056	600
0·1500	1,056	600
0·2000	1,056	600
0·2500	1,056	600
0·3000	1,056	600
0·4000	1,056	600
0·5000	1,056	600
0·6000	1,056	600
0·7500	1,056	600
1·0000	1,056	600

INSTALLING AND FIXING OF CABLES.

1. **Cable Sockets and other Connections.**—The ends of all cables having a sectional area of 0·007 square inch and above shall be provided with soldering sockets.

Soldering fluids containing acid or other corrosive substances shall not be used.

When soldering or securing the ends of cables to sockets or terminals, the dielectric shall not be removed farther than is necessary to allow the conductor to enter and completely fill the socket or terminal.

The braid, lead, or other covering over the dielectric, including the tape in contact therewith, shall be cut back at least half an inch from the end of the dielectric.

In the case of paper-insulated cables, the exposed conductor and dielectric shall be protected from moisture by being suitably sealed with insulating compound.

2. **Selection of Cable Runs.**—Cables shall be fixed as far as possible in accessible positions, so chosen that they are not exposed to drip or accumulation of water or oil, to high temperature from boilers, steam pipes, uptakes or other hot objects, or to avoidable risk of mechanical damage.

The runs shall be as direct as possible and no unarmoured rubber-insulated cable shall be bent to a shorter radius than twice its overall diameter, and no armoured rubber-insulated cable to a shorter radius than three times its overall diameter.

3. **Support and Protection of Cables.**—If not exposed to risk of mechanical damage cables may be secured in one of the following ways:—Cables of all classes may be run in wood casing in dry situations. The casing and capping shall be secured by screws, which for the capping shall be of brass, and on the outer edges only. Precautions shall be taken to ensure the separation of cables run in separate grooves where cables cross one another.

Armoured cables and lead-covered cables, when not run in wood casing, shall be secured by metal clips having smooth or rounded edges, and effectual means shall be taken to ensure that the electrical resistance between any two points of the metallic envelopes of such cables does not exceed 2 ohms. Such clips shall be firmly secured by screws of ample strength, and shall be spaced in accordance with Table VI. Armoured cables having a sectional area of 0·25 square inch and upwards may be carried by metal hangers instead of being secured by clips. Metal staples shall not be used for any class of cable.

TABLE VI.

MAXIMUM SPACING OF CLIPS SECURING LEAD-COVERED OR ARMOURED CABLES.

Overall Diameter of Cable.	Lead-covered.	Armoured.
	Inches.	Inches.
Under 0·3 inch	8	10
0·3 inch and under 0·5 inch	10	12
0·5 „ „ 0·75 „	12	14
0·75 „ „ 1·25 „	14	16
1·25 inches and above ...	16	18

4. If cables are exposed to risk of mechanical damage, they shall be efficiently protected by sheet-iron plating or by other approved means.

Cables in machinery spaces or where unavoidably exposed to the weather or to the action of sea water shall be lead-covered, and may be armoured in addition, with or without braiding over the armour.

Cables entering refrigerating chambers shall pass normally through the insulation of the chamber, and shall be protected by a continuous lead tube flanged over at each end.

Cables fixed within refrigerating chambers shall not be embedded in the insulation, but be in full view throughout their length. They shall in all cases be lead-covered, with the covering efficiently earthed, and shall be supported by clips made of porcelain, hard wood, or other non-metallic and non-hygroscopic material.

Conductors of opposite polarity may be bunched if carrying direct current; if carrying alternating current they shall be bunched. When protected by wood casing braided cables of the same polarity may be bunched, but those of opposite polarity shall be run in separate grooves. Lead-covered and armoured cables may in all cases be bunched, whatever their polarity.

5. **Joints during Erection.**—All connections between rubber-insulated cables shall be made by means of joint boxes, and those between cables and flexibles by means of clamped connections contained within suitable receptacles, which in the case of lamp fittings may form part of such fittings. Joints in flexibles are not permissible.

Connections between lead-covered paper-insulated cables may be made by the same means as for rubber-insulated cables, the insulation at their ends being suitably sealed against moisture; or the conductors may be joined by means of copper sleeves, or by marrying or telescoping the strands, the whole being sweated together. Joints made in this manner shall be lapped with paper or pure cotton tape, impregnated immediately before use, and be enclosed in boxes, or, preferably, lead sleeves or tees wiped on to the cable coverings, these receptacles being filled with an insulating compound impervious to moisture. Lead sleeves and tees shall be painted with two coats of tough elastic enamel on completion of the joint.

6. **Watertight Glands and Deck Tubes.**—All cables passing through decks or watertight bulkheads shall be provided with deck tubes or watertight glands.

7. **Cables passing through Beams and Non-Watertight Partitions.**—Unarmoured cables passing through beams and non-watertight partitions shall have the holes through which they pass bushed with lead or other soft non-ferrous metal. Armoured cables need not be bushed.

MAIN DISTRIBUTION.

1. **Subdivision of Circuits.**—Every installation shall have its individual lamps and other devices consuming small currents grouped into circuits taking not more than 600 watts, and the maximum number of points on each such final sub-circuit shall not exceed ten. These final sub-circuits shall radiate from a sub-distribution board.

Every sub-distribution board and every lamp or other consuming device taking more than 600 watts shall be connected to a separate way on a section or main distribution board. Each section or main distribution board shall in turn be connected either to a separate way on the main switchboard or to one way of a distribution board for larger currents, which in turn shall be connected to the main switchboard or to one way of a distribution board for still larger currents. The number of such distribution boards intervening between the final sub-distribution boards and the main switchboard will depend upon the size and disposition of the installation.

2. **Control of Circuits.**—Each two-wire circuit on a distribution board whether supplied from a two-wire system, from a three-wire system with insulated neutral, from a three-phase four-wire system with insulated neutral, or from a three-phase three-wire system, shall be controlled by a fuse on each insulated pole, and, except in the case of a sub-distribution board, by a switch on one insulated pole.

No fuse or switch shall be connected to that pole of the circuit which is either earthed or derives its polarity from an earthed conductor.

The neutral conductor of a three-wire system or of a three-phase four-wire system whether earthed or not, shall never be interrupted by a fuse or switch.

Every three-conductor circuit supplied from all three conductors of a three-phase system shall be controlled by a triple-pole circuit breaker with overload trips on at least two phases, or by a triple-pole linked switch and by a fuse on each pole.

3. **Earthing Connections.**—Every conductor used for earthing purposes which does not normally carry current, shall be of copper having the same sectional area as the

working conductor, but not less than 0·003 square inch, for all sizes up to 0·007 square inch. Above this size a conductor of not less than 0·007 square inch shall be provided for every 50 amperes of working current or part thereof.

Every conductor used to carry the working current of a circuit to the ship's structure on the single-wire system of distribution shall be of the same sectional area as the corresponding conductor of the insulated portion.

All connections to the ship's structure shall be in accessible positions.

Solid wires shall be connected to the ship's structure by being made into a hook and placed under a brass washer and secured by a screw of not less than $\frac{3}{8}$ inch diameter used for this purpose only.

Cables shall be provided with cable sockets secured to the ship's structure by screws of not less than $\frac{3}{8}$ inch diameter.

In all cases care shall be taken to ensure bright metallic surfaces at the contact areas immediately before screwing up.

4. **Alternative Lighting.**—Alternate groups of lamps in engine and boiler-rooms shall be supplied from circuits so arranged that the fusing of any one cut-out (other than a cut-out on the main switchboard) will not leave these spaces in darkness.

5. **Emergency Supply.**—Where the Board of Trade require an emergency supply to be provided it shall be adequate in amount, and so disposed as to meet all requirements concerning safety imposed by the Board of Trade.

The emergency circuits shall be connected direct to a change-over switch, or switches, fitted near the source of emergency supply, enabling these circuits to be quickly transferred from the ordinary to the emergency source.

6. **Interference with Magnetic Compasses.**—Dynamos, motors, secondary batteries, control gear, resistances and all apparatus producing an external magnetic field when in use shall be fitted at such distances from the compass bowl, as will reduce the magnetic field produced by such apparatus to a negligible value thereat.

No single-conductor circuit carrying continuous current shall be fitted within 30 feet of standard and steering compasses. In order that the lead and return currents shall neutralize one another in two-conductor systems, conductors in the vicinity of the compass shall preferably be twin; if separate, they shall be fixed as close to one another as possible, and be equidistant from the compass throughout their length. Conductors within the compass binnacle shall be as short and direct as possible; if separate, they shall be twisted together and shall not be coiled into spiral loops.

Incandescent electric lamps employed for illumination of the compass card shall not consume more than 0·6 ampere. Such lamps shall be so placed that no live part is at a less distance than 7 inches from any part of the magnetic system of the compass.

Careful tests shall be made during the adjustment of the compasses. The effect of switching on and off circuits, motors and other electro-magnetic apparatus within the vicinity of the compasses, shall be noted and careful records kept of any errors observed, whether corrected or not.

7. **Navigation Lamps.**—Each navigation lamp shall be separately wired and be controlled by a separate switch and separate fuses which shall be double-pole unless one conductor of the system be earthed; such switches and fuses shall be grouped in a position accessible only to the officers of the watch.

Each navigation lamp shall have an automatic indicator in its circuit placed on or adjacent to its switch and arranged to give an aural and/or visual signal in case of extinction of the light by breakage of the lamp filament or from other cause.

When electric lanterns for side-lights are fitted, separate lanterns and separate screens are to be provided for the use of oil and electric light.

Separate oil lanterns shall be provided for masthead lights.

FITTINGS.

1. **General Requirements.**—Fittings shall be watertight on weather decks, in stokeholds and engine rooms, and wherever exposed to drip or condensed moisture. In spaces in which goods are liable to be stacked in close proximity to them, they shall be provided with substantial metal guards.

Open type fittings whether fixed or portable shall not be used in spaces where inflammable or explosive dust or

gases are liable to be present or where inflammable goods are stored, nor in positions in which the lamp is either near to, or can swing near to, readily combustible materials.

Switches and other fittings liable to arc when operated shall not be installed in bunkers or other spaces in which inflammable or explosive dust or gases are liable to be present, whether controlling lights in such spaces or not.

In vessels having spaces allotted alternately for passengers and cargo, the lamp fittings in these spaces should be removable, and the terminals so arranged that they can be properly covered up with strong metal covers or the whole of the fittings should be similarly provided with strong metal covers. The main switches and fuses should be outside these spaces, or, if placed inside, they should be in strong iron boxes provided with iron covers, or otherwise securely arranged to prevent the fittings being tampered with.

2. Lampholders shall be of the Goliath type for lamps consuming more than 300 watts.

3. Ceiling roses shall be of incombustible non-conducting non-hygroscopic material.

4. The live parts of plugs and sockets shall be so proportioned that their average temperature shall not rise more than 54 degrees F. above that of the surrounding air when the normal working current is flowing through them continuously.

Watertight plugs and sockets shall be employed on weather decks, in stokeholds and engine rooms, and wherever exposed to drip or condensed moisture.

5. Searchlight lamps shall have the whole of their live parts insulated from the frame or case.

All parts of a searchlight lamp which have to be handled for its operation or adjustment while in use shall be insulated from the circuit with strong, incombustible material, of substantial proportions, and be so disposed that there is no risk of shock to the operator.

Every searchlight circuit shall be controlled by a fuse on each insulated pole, and by a double-pole linked switch.

6. Arc lamps, other than searchlight lamps, shall have the whole of their live parts insulated from the frame or case.

Every arc lamp shall be provided with a globe or lantern arranged to intercept falling particles of carbon, and with wire netting or other means of preventing pieces of broken glass falling.

Every arc lamp circuit shall be controlled by a fuse and switch on each insulated pole. Where more than one pole is insulated the switches shall be linked.

Arc lamps shall not be fitted in spaces in which combustible goods are stored, or in which inflammable gases may accumulate.

MOTORS.

1. **General Construction.**—All working parts shall be readily accessible.

All coils shall be self-contained and readily removable for replacement.

The brushes shall be of carbon, and shall be provided with flexible copper connections. Means shall be provided for the adjustment of the brushes longitudinally, so that they may be staggered in such a manner that in multipolar machines every part of the commutator working surface will be swept by an equal number of positive and negative brushes in order to avoid unequal wear.

Suitable terminals clearly marked and provided with cable sweating sockets shall be provided in an accessible position, convenient for wiring.

The terminals shall be so spaced and/or shielded that they cannot be accidentally earthed, short-circuited, or touched.

Motors shall be efficiently and continuously lubricated automatically with the base of the machine inclined at any angle up to 15 degrees from the horizontal in any and every direction.

2. **Position in Ship.**—Motors shall, wherever possible be placed in well-ventilated compartments in which inflammable gases cannot accumulate, and in all cases shall be fixed clear of all inflammable material.

They shall, as far as possible, be placed in positions in which they are not exposed to risk of mechanical injury or to damage from water, steam, or oil.

In all sea-going ships, motors shall, wherever possible, be placed with their axes of rotation in a fore and aft direction.

No unprotected woodwork or other combustible material shall be within a distance of 12 inches measured horizontally from, or within 4 feet measured vertically above, any motor, unless it be of the totally enclosed, pipe-ventilated, forced-draught, drip- or flame-proof type.

CONTROL GEAR AND RESISTANCES.

1. **General Construction.**—Generator field and motor speed regulators, starters, and controllers, shall be constructed wholly of durable, incombustible, non-hygroscopic material, and unless otherwise guarded from approach shall be enclosed in incombustible cases.

All switch parts and protective devices shall be so proportioned that their temperature shall not rise more than 54 degrees F. above that of the surrounding air, when the normal working current for which they are designed flows through them continuously.

The contact-making faces shall be sufficiently numerous to prevent destructive arcing, and shall be readily renewable without dismantling the gear.

Handles and their attachments shall be mechanically strong, and so designed and guarded that the hand of the operator cannot touch live metal.

All live parts shall be enclosed by metal covers, which shall be clear of such live parts by not less than $\frac{3}{4}$ inch. Those portions of the cover in proximity to working contacts shall be lined with incombustible insulating material.

2. Resistances shall be so proportioned that they do not rise to such a temperature as seriously to impair their durability.

Internal connections shall not be soldered, and all such connections, unless self-supporting or rigidly fixed in position, shall be continuously insulated with porcelain beads.

Suitable terminals with cable sockets shall be provided for the attachment of external leads, and shall be so situated that such leads are not exposed at any point to a high temperature.

3. **Position in Ship.**—Control gear shall be placed in positions in which inflammable gases cannot accumulate, and, as far as possible, shall be placed in positions in which it will not be exposed to risk of mechanical injury or to damage from water, steam, or oil. Where necessarily exposed to such conditions it shall be totally enclosed.

All resistances shall be placed in well-ventilated compartments in which inflammable gases cannot accumulate, and in such positions as to be clear of all inflammable material. No unprotected wood-work or other combustible material shall be within a distance of 6 inches measured horizontally from, or within 24 inches measured vertically above, the frames or the cases containing them.

MISCELLANEOUS.

1. Communication cables shall not be fixed in the same groove as cables supplying lighting and power.

2. Lightning conductors shall be fitted to each mast of all wooden vessels and of steel vessels having wooden masts. They need not be fitted to steel vessels having steel masts.

3. In wooden ships or ships sheathed with wood the lightning conductors shall be composed of a continuous copper tape or rope, having a section not less than 0·15 square inch which shall be riveted or clamped to a suitable copper spike attached to the mast-head. If of tape the lower end shall terminate at the point at which the shrouds leave the mast, and be securely clamped to a copper rope of not less than $\frac{1}{2}$ inch in diameter. This copper rope shall be led down the shrouds and be securely attached to the metal sheathing or, in unsheathed vessels, clamped to a galvanized iron plate not less than 2 square feet in area fixed well below the light-load water-line and attached to the ship's side.

4. Steel ships fitted with wooden masts shall have lightning conductors composed of copper tape terminating in a spike. At the lower end this copper tape shall be securely attached to the nearest metal forming part of the hull of the ship.

5. In all cases the lightning conductor shall be so run as to avoid sharp bends in the conductor.

6. It is recommended that suitable means be provided to enable ships when in dry dock to have their lightning conductors connected to an efficient earth on shore.

SPECIAL REQUIREMENTS FOR SHIPS CARRYING OIL HAVING A FLASH POINT LESS THAN 150° F.

1. The pressure of supply shall not exceed 110 volts whether the current be direct or alternating.

Every outgoing circuit from the main switchboard and every branch and sub-circuit shall be provided with a double-pole linked switch.

The cases of all joint boxes, section and distribution boards shall be wholly of metal, and all cables shall enter them through watertight glands.

All cables shall be lead-covered or lead-covered and armoured.

Distribution shall be effected wholly on the two-wire two-conductor system with separate conductors, both

insulated, for the respective poles; no part of the system shall be earthed.

2. **Dangerous Spaces.**—No lamp, fitting or appliance of any kind, and no wiring may be fitted in, or enter, any of the following dangerous spaces: Oil-holds, cofferdams.

Pump rooms may be lighted by lamps wired wholly outside the space and separated from the interior by an air-tight stout glass bowl.

Lamps in pump-rooms, 'tween decks and spaces immediately adjoining oil-holds shall be contained in gas-tight fittings, the wiring being enclosed in gas-tight tubing. The switches controlling them shall be wholly outside these spaces. These switches shall in all cases be double-pole.

No portable lamps other than self-contained battery-fed lamps of a type approved by the Home Office for use in fiery mines may be used in dangerous spaces. All fittings therein shall be gas-tight.

FEES FOR THE INSPECTION OF THE INSTALLATION OF ELECTRICAL FITTINGS ON BOARD VESSELS.

The following Scale of Fees has been adopted for the inspection of the installation of Electrical Fittings on board vessels in the United Kingdom, viz. :—

£1 per kilowatt for the first 15 kilowatts,
10s. „ „ „ each kw. from 15 to 30 kilowatts,
5s. „ „ „ „ „ „ 30 to 50 „
2s. „ „ „ „ „ „ 50 to 80 „
1s. „ „ „ „ „ „ 80 to 200 „
6d. „ „ „ „ „ above 200 kilowatts,

Minimum fee £5.

(The scale is based on the kilowatts of the generators.)

By order of the Committee,
ANDREW SCOTT,
Secretary.

71, Fenchurch Street, London, E.C. 3.
9th December, 1920.

REFRIGERATING MACHINERY AND APPLIANCES.

On the application of the owners of vessels fitted for carrying refrigerated cargoes, the Committee will authorize their Surveyors to survey the refrigerating machinery and appliances, and in those cases where the following conditions are complied with and a satisfactory report is received from the Surveyor, certificates of these Surveys will be issued and the notation Lloyd's R.M.C. (*in red*) (*i.e.* Refrigerating Machinery Certificate) will be made against the vessel's name in the Society's Register Book, and in the special list of vessels fitted with refrigerating appliances. In cases in which the refrigerating machinery and appliances are constructed under the special survey of the Society's Surveyors and to their entire satisfaction, the notation ✠ Lloyd's R.M.C. (*in red*) will be made in the Register Book. The name of the maker and description and number of the refrigerating machines, whether single or duplex, and the refrigerating power of the machines will be recorded in the special list in the Register Book, as will also the number and capacity of insulated cargo chambers and the nature of the insulation and the method employed for cooling the holds.

1. The insulation must be sound and in good order and of efficient construction. The details of construction showing the amount and nature of the insulating material employed in the various parts are to be reported to the Committee.

Bilge suction and sounding pipes and ballast tank air and sounding pipes, passing through insulated spaces, should be well insulated to prevent their being frozen up. No sluice valves, scuppers or drain pipes are to be fitted which will permit drainage from spaces outside of the insulated chambers into the bilges of the insulated holds.

It is *recommended* that the wood-work of the insulation over tunnel tops be fastened with screws to facilitate the examination of this part, and that extra strong battens of American Elm be fitted upon it under the hatches. Insulated removable portions are to be arranged in the bulkhead insulation, where required, to give easy access to sluice valves and bilge suction roses. The bottoms, sides and coamings of all insulated hatches and limbers should be painted to prevent decay.

Thermometer tube flanges and covers should be arranged so that water does not run down and freeze in them when taking the temperature.

Cargo battens should be provided for the floor or deck and the sides of the chambers previous to loading the homeward cargo. Those for the sides of the chambers should be fastened, and should be at least $1\frac{1}{2}$ inches in depth and 2 inches wide, one batten being placed over each frame or ground, the others being intermediately arranged. The battens for the floor and decks should be at least $2'' \times 2''$.

Where the brine system of refrigerating is employed, the brine circulating pipes and tanks should not be galvanized on the inside.

In cases where internally galvanized tanks and cooling pipes have been fitted, the brine cooling and return tanks, if closed, should be provided with two ventilating pipes communicating with the atmosphere. If the tanks are not closed, the cooling room should be efficiently ventilated.

2. The refrigerating machinery is to be of approved construction and of sufficient power to maintain the necessary low temperature in the cargo chambers in tropical climates when running 18 hours per day. For cargo capacities of above 70,000 cubic feet the machinery is to be either duplex or in duplicate.

3. A sufficient amount of spare gear is to be supplied and stowed where it is readily accessible.

No spare gear will, however, be required in cases where two complete sets of refrigerating machines are fitted *each* being of sufficient power to maintain the necessary low temperature in the cargo chambers in tropical climates when running 18 hours per day, provided all the working parts of these machines are interchangeable.

When two similar machines are fitted, each connected to different cargo compartments, one set of spare gear suitable for either machine will suffice.

Where one single dry air machine is fitted to each compartment, the following will be required :—

1 crank shaft with eccentric sheaves, complete, or one half shaft if the halves are interchangeable.
1 piston rod and nuts for steam and air cylinders.
1 set of piston rod and connecting rod brasses.
1 piston, complete, for each steam and air cylinder.
1 cylinder cover for each pattern used in steam and air cylinders.
1 air pump bucket and rod.
1 circulating pump bucket and rod.
1 pair main bearing brasses, complete.
Main and cut-off valves for each steam cylinder.
Balance springs and rings for steam and air slide valves.
False valve face for each pattern fitted in steam cylinders, with screws.
1 eccentric rod for each pattern used.
1 eccentric strap for each pattern used.
1 slide valve spindle and nuts for steam and air cylinders, for each pattern used.
2 main bearing bolts.
1 set of connecting rod and piston rod bolts.
Full set of air valves and seats for air compressor.
1 set of inlet and outlet valves, and 1 set valve faces (if fitted) for air expansion cylinder with screws.
1 set of valves for air, circulating and feed pumps.
1 set of escape valve springs.
50 suction springs.
50 delivery springs.
50 buffer springs.
6 tubes and 24 ferrules for condenser.
6 tubes for cooler.
6 tubes for air drying chamber.
Assorted bolts, studs and nuts.
1 set of lead lined nuts for air expansion cylinder cover.
A quantity of packings and joint rings.

Where one duplex or two single dry air machines are fitted to each compartment the following will be required :—

1 crank shaft with eccentric sheaves complete, or one half shaft if the halves are interchangeable.
1 piston rod and nuts for steam and air cylinders.
1 set of connecting rod and crosshead brasses.
1 piston for H.P. steam cylinder.
1 piston, complete, for air compressor ; and 1 for air expansion cylinder.
1 set of piston springs for each steam cylinder.
1 cylinder cover for each pattern used in air compression and expansion cylinders.
1 air pump bucket and rod.
1 circulating pump bucket and rod.
Main and cut-off slide valves and spindles with nuts complete for H.P. steam cylinder.
Balance springs and rings for steam and air slide valves.
1 H.P. steam cylinder valve and valve face with screws.
1 eccentric sheave, strap, and rod for each pattern used.
1 slide valve spindle and nuts for steam and air cylinders for each pattern used.
2 main bearing bolts.
1 set of connecting rod and piston rod bolts.
Half set of air valves and seats for air compressor.
1 inlet and 1 outlet valve, and half set of valve faces (if fitted) for air expansion cylinder, with screws.
1 set of valves for air, circulating, and feed pumps.
1 set of escape valve springs.
20 suction springs.
40 delivery springs.
40 buffer springs.
6 tubes and 24 ferrules for condenser.
6 tubes for cooler and 6 for air drying chamber.
Assorted bolts, studs and nuts.
$\frac{1}{2}$ set of lead lined nuts for air expansion cylinder cover.
A quantity of packings and joint rings.

Where one single ammonia or carbonic anhydride compression machine is fitted :—

1 crank shaft with eccentric sheaves, complete, or one half shaft if the halves are interchangeable.
Piston and rods complete with nuts for each steam cylinder and gas compressor.
1 air pump bucket and rod.
1 circulating pump bucket and rod.
1 pair main bearing brasses, complete.
1 set of connecting rod and crosshead brasses.
Main and cut-off valves for steam cylinders.
1 valve spindle for each pattern used and nuts complete.
1 eccentric strap and rod for each pattern used.
1 brine pump complete.

1 cover for each pattern used.
2 main bearing bolts.
1 set of connecting rod and piston rod bolts.
1 set compressor suction and delivery valves with springs and boxes, complete.
1 set of valves for air, circulating, feed, and brine pumps.
Crank shaft for fan engine.
1 steam piston and rod, etc., for fan engine, complete.
1 pair of connecting rod brasses for fan engines, with bolts, etc., complete.
1 set of blocks for making all leather packings used.
6 tubes and 24 ferrules for condenser.
Lengths and bends of piping of each size used, together with flanges, couplings, and screwing apparatus for effecting repairs.
1 gas regulating valve.
1 distributing and 1 collecting piece with multiple branches for coils for each pattern used. If these pieces are made of forged steel no spare pieces are required.
Sundry valves, cocks, flanges, and fittings.
Assorted bolts, studs, and nuts.
Quantity of leather packings and joint rings.

For ammonia and carbonic anhydride compression machines, the following spare gear will be required, where one duplex or two single machines are fitted to each compartment :—

1 crank shaft, or one half shaft if the halves are interchangeable.
1 steam piston rod and nut for each pattern used.
1 piston for H.P. steam cylinder, with springs, complete.
1 set of piston rings for each steam cylinder.
1 set of piston rings for each size of compressor.
1 compressor piston rod and nuts, complete, for each pattern used.
1 air pump bucket and rod.
1 circulating pump bucket and rod.
Main and cut-off slide valves for H.P. steam cylinder.
Main and cut-off valve spindles and nuts for H.P. steam cylinder.
1 eccentric sheave, strap, and rod, for each pattern used.
1 brine pump complete.
1 cover for each end of gas compressor, except where screwed plugs are used.
2 main bearing bolts.
$\frac{1}{2}$ set of connecting rod and piston rod bolts.
$\frac{1}{2}$ set compressor suction and 1 delivery valve with springs and box, complete.
1 set of valves for air, circulating, feed, and brine pumps.
1 steam piston and rod, etc., for fan engine, complete.
1 pair of connecting rod brasses for fan engines, with bolts, etc., complete.
1 set of blocks and leather for making all leather packings used.
6 tubes and 24 ferrules for condenser.
Lengths and bends of piping of each size used, together with flanges, couplings, and screwing apparatus for effecting repairs.
1 gas regulating valve.
1 distributing and 1 collecting piece with multiple branches for coils for each pattern used. If these pieces are made of forged steel no spare pieces are required.
Sundry valves, cocks, flanges and fittings.
Assorted bolts, studs and nuts.
A quantity of joint rings.

In cases where an independent circulating water pump is used, and its work *cannot* be performed by the main or auxiliary engines, a duplicate pump complete should be fitted.

In cases where an independent circulating water pump is used, and its work *can* be performed by the main or auxiliary engines, a pump bucket and rod should be carried, and $\frac{1}{2}$ set of valves for water end.

In cases where an independent surface condenser with air, circulating and feed pumps combined is fitted, and its work *cannot* be performed by the main engines :—

1 crank shaft with eccentric sheaves complete.
1 piston and rod complete for each pattern used.
1 eccentric strap and rod complete for each pattern used.
1 slide valve and spindle complete for each pattern used.
1 pump bucket and rod complete for each pattern used.
1 set of connecting rod and piston rod bolts and nuts.
1 set of valves for air, circulating, and feed pumps.
6 condenser tubes and 12 ferrules.

In cases where an independent surface condenser with air, circulating, and feed pumps combined is fitted, and its work *can* be performed by the main engines :—

1 pump bucket and rod complete for each pattern used.
1 set of connecting rod and piston rod bolts and nut.
½ set of valves for air, circulating, and feed pumps.
6 condenser tubes and 12 ferrules.

Periodical Surveys.

4. In the cases of vessels engaged on voyages of more than three months' duration, a complete examination, as detailed in par. 9, is required every voyage. If this examination is made at other than the loading port a further examination is required at the loading port. (*See* par. 11.)

5. In the cases of vessels engaged on voyages of more than two and not more than three months' duration, a complete examination as above detailed is required at each alternate voyage, but at the intermediate voyage a modified examination as described in par. 10 will be sufficient, but the survey at loading port provided for in par. 11 should be held every voyage.

6. In vessels engaged on shorter over-sea voyages, the above examinations are to be held at least every three months, alternate examinations being as provided for in pars. 9 and 10, but the survey at loading port provided for in par. 11 should be held every voyage.

In the cases of vessels engaged on voyages of only a few days' duration, the complete examinations are to be held at least every three months, alternate examinations being as provided for in pars. 9 and 10, but the examination of insulation, etc., provided for in par. 11, instead of being held every voyage need only be held at intervals of four or six weeks, as may be approved in each special case.

7. *If in any case only part of the requisite examinations is held, the certificate will be endorsed with a statement of what is required to complete the survey.*

8. The date following the record Lloyd's R.M.C. *in red* indicates the date of the last examination of the Refrigerating Machinery and appliances as above mentioned.

When the periodical Surveys provided for in pars. 4, 5 and 6 are not held, the record Lloyd's R.M.C. will be expunged.

9. The complete periodical Survey required in par. 4 will consist of the following :—

The insulation throughout the holds is to be carefully examined and tested for dryness and fullness by sounding with a hammer and by boring. The test holes are to be afterwards efficiently closed. Special attention is to be paid to the spaces under the snow boxes, trunks and hatches where dampness may accumulate, to the sides under stringers and under decks and to the tunnel tops. All limber hatches are to be removed, the limbers cleared, and the suction pipes and roses, sluices and sounding pipes are to be examined. Hatches, air trunk-ways and thermometer tubes with their connections and fastenings are to be examined, and where trunk-ways pass through watertight bulkheads, the watertight doors are to be examined and worked.

The trunk-ways should be as airtight as practicable and their fastenings should be secure.

The steam pipes, water pipes and connections, the crank shaft and bearings, connecting rods, steam and air cylinders, pistons, slides and valves, compressors and pistons, compressor rods and glands, surface condenser and air or gas coolers, circulating, air, feed and bilge pumps, are to be carefully examined and the condensers and coolers tested if deemed necessary.

The auxiliary machinery, where fitted, is also to be examined.

The spare gear is to be examined.

In dry air machines special attention is to be given to the condition of the air expansion cylinders, their pistons and valves. In other machines special attention is to be given to the condition of the compressors, including the pistons, rods and glands, and to the expansion valve.

The refrigerator coils and their connections and the brine pipes and tanks, where fitted, are to be carefully examined and tested if deemed necessary.

Where the brine may escape to the bilges, the cement is to be examined.

The machinery is to be examined under working conditions, and tested on the snow box or refrigerators, the time and fall of temperature being noted.

It is *recommended* that the examination of the machinery under working conditions should be made upon the vessel's arrival at a home port, before the cargo is *fully discharged*. Where brine pipes are fitted they should be examined when under frosted conditions.

10. The examination required at alternate voyages in pars. 5 and 6 will consist of the following :—

The Insulation and Trunkways are to be surveyed in the same manner as is required for the complete examination detailed above. (*See* par. 9.)

Provided the machinery when tested under working conditions is found to be satisfactory, the following parts only will be required to be examined at this Survey, viz. :—

Steam valves, air pump and circulating pump.
Crank shafts and bearings.
Air and other compressors and valves.
Expansion cylinder and valves in dry air machines.
Condenser water spaces.
Sea injection valves to be opened whenever the vessel is in dry dock.
Brine pipes in holds under frosted conditions.
The spare gear.

11. If the machinery and insulation have been surveyed and passed at a home port, the further survey required at a loading port will consist of an inspection to ascertain that the dunnage battens are in good order and that no damage has been sustained to the insulation prior to the loading of the refrigerated cargo, and also of a test of the refrigerating machinery under working conditions, the temperature in the hold being noted.

If the vessel loads at more than one port, one survey only at a loading port will be required, provided it includes the examination of all insulated spaces.

If there is no Surveyor to the Society available at the loading ports, or if there is not one obtainable from a port within a reasonable distance, this survey may be held at the port where the outward cargo is discharged; or the Committee will accept the report of a survey held at the loading port by a Surveyor appointed by Lloyd's Agent; or (in any case where there is no Lloyd's Agent) the report of a survey held by a reliable Surveyor, if available; or (if no such Surveyor is available) a report signed by two competent Engineers of the vessel.

Fees.

12. The following are the charges that will be made for carrying out the above examination in the cases of classed vessels :—

FOR INSTALLATIONS C.F. TOTAL CAPACITY.	During Construction.			Subsequent Periodical Surveys.		
	£	s.	d.	£	s.	d.
Under 80,000 ...	9	0	0	5	0	0
80,000 and under 120,000 ...	12	0	0	6	0	0
120,000 and under 180,000 in not more than 6 compartments ...	15	0	0	8	0	0
120,000 and under 180,000 in more than 6 compartments	18	0	0	9	0	0
180,000 and under 250,000 in not more than 8 compartments ...	21	0	0	11	0	0
180,000 and under 250,000 in more than 8 compartments	24	0	0	12	0	0
250,000 and under 330,000 in not more than 10 compartments ...	24	0	0	12	0	0
250,000 and under 330,000 in more than 10 compartments	27	0	0	14	0	0
330,000 and under 400,000 in not more than 12 compartments ...	30	0	0	15	0	0
330,000 and under 400,000 in more than 12 compartments	36	0	0	18	0	0
Above 400,000 in not more than 14 compartments ...	36	0	0	18	0	0
Above 400,000 in more than 14 compartments ...	42	0	0	21	0	0

As regards Unclassed Vessels the fees for the first survey of Refrigerating Machinery and Appliances will be double the amounts in column No. 1. Fees for subsequent surveys will be charged in accordance with column No. 2 as printed.

By order of the Committee,

ANDREW SCOTT,
Secretary.

71, FENCHURCH STREET, LONDON, E.C.

17*th June*, 1920.

EXTRACTS FROM THE RULES

OF THE LATE

UNDERWRITERS' REGISTRY FOR IRON VESSELS (FOR 1884-85)

(NOW UNITED WITH LLOYD'S REGISTER OF SHIPPING),

SHOWING THE CONDITIONS OF CLASSIFICATION, &c.

REVISION OF CERTIFICATE OR SUSPENSION OF CLASS.

The certificate of class will remain good so long as the vessel, under periodical survey, is found worthy of it. In case of defects reported by the Surveyors not being made good, the class of the vessel will be revised or suspended by the Committee.

REFERENCE IN CASE OF COMPLAINT.

Any dispute shall be referred to three Shipbuilders or Engineers, one to be chosen by the Shipowner, one to be chosen by this Committee, and a third to act as umpire, to be chosen by the other two.

SURVEY FEES.

For surveying vessels periodically to ascertain condition, first visit £1 1 0

For each succeeding visit, when more than one visit is necessary 0 10 6

For special surveys special charges will be made, subject to the control of the Committee.

PERIODICAL SURVEYS.

A thorough survey will be required once in every four years for vessels with an A1* or an A1* certificate; and once in every three years for vessels with an A1, A1, A or an A certificate. When vessels are abroad at the time they become due for survey, they must be examined on their return to the United Kingdom. The Surveyors are at all times to have free access to examine vessels holding a class in this Registry.

Vessels due for Periodical Survey which leave the United Kingdom without being duly surveyed and passed by the Surveyors to this Registry will have their class suspended until such survey has been properly made. Notice of Suspension of Class will be given in the first Supplement issued after the sailing of the vessel.

Vessels remaining abroad for two years after they become due for Periodical Survey will have their Class suspended until they have been re-surveyed.

First Survey.

The vessel to be placed in dry dock. (The bottom may be cleaned, but should not be recoated before survey.) While in dry dock the rudder, rudder pins and gudgeons, and the whole of the bottom outside, are to be thoroughly examined, and in steamers the connections of the sea-cocks and openings in the bottom are to be examined, to see that they are in an efficient condition.

The holds, and, in steamers, the bunkers also, are to be cleared, the loose ceiling in the flat of bottom is to be lifted, and the Surveyor is to satisfy himself that the bottom inside is in good order, and that the cement is in good condition and satisfactorily adhering to the iron.

He is also to examine the decks, beam ends, and the sides of holds and 'tween decks, all fore and aft. In steamers the bilges and limbers under engines and boilers are to be cleaned out, so as to allow these parts to be examined by the Surveyor. In water-ballast steamers the tanks are to be examined externally and, if the Surveyor deems it necessary, they are to be tested under the pressure due to the ballast-trim water-line, and sufficient ceiling removed to enable the Surveyor to satisfy himself of their tightness. In all cases the tanks are to be emptied, and examined inside. In all vessels any repairs that may be needed are to be done, and the vessel cleaned and painted as may be necessary.

Second Survey.

The vessel to be submitted to the same survey as before described for "First Survey," with the following additions :—

A strake of ceiling must be lifted in the bilges to allow an examination of the condition of the iron surfaces there and of the cement.

The windlass must be unhung when the main piece is of wood ; and the chain cables must be ranged out for examination. In steamers the water ballast tanks must be tested under the pressure due to ballast-trim water-line.

Third Survey.

The vessel to be submitted to the same survey as before described for "First Survey," with the following additions :—

The whole of the close ceiling must be removed, and all the cement exposed and examined. The vessel must be cleaned and scaled, and, if the Surveyor deems it necessary, the plating and other parts must be drilled as he may direct, to ascertain the thickness. In steamers the water ballast tanks must be tested under the pressure due to ballast-trim water-line.

Fourth Survey.

The vessel to be submitted to the same survey as before described for "First Survey," with the following additions :—

The windlass, if the main piece is of wood, must be unhung, and the chain cables ranged out for examination. In steamers the water ballast tanks must be tested under the pressure due to the ballast trim water-line.

Fifth Survey.

The vessel must be submitted to the same survey as before described for "Second Survey."

Sixth Survey or Special Survey.

The vessel must be submitted to the same survey as before described for "Third Survey," with the following additions :—

The actual condition and thickness of all the scantlings must be ascertained, the shell plating being drilled on at least three vertical lines in each strake viz., forward, amidships, and aft, and elsewhere, at the discretion of the Surveyor, as he may direct.

A report of the vessel's condition and scantlings is to be submitted to the Committee, and such part or parts as they may direct are to be renewed, or otherwise strengthened.

After a vessel has passed her sixth survey, and been approved by the Committee she must be submitted to the same series of surveys, commencing with the "First Survey," and at the same periodical intervals as before.

In steamers, whenever the engines or boilers are removed, a survey is to be held on the vessel's bottom in way thereof, and such repairs as are necessary must be effected before the engines or boilers are replaced.

The preceding rules for periodical surveys are not to limit the Surveyor's discretion, if, in his judgment, it is necessary to make a more complete examination at any time ; and, before completing the report, the Surveyor must, at every periodical survey, satisfy himself that the vessel and her equipment are in a good and efficient condition.

The "Third Survey" must be complied with before the expiration of thirteen years from the date of launch for vessels with an A1* or A1* certificate, ten years for vessels with an A1 or A1 certificate, and nine years for vessels with an A or A certificate ; and the "Sixth Survey" before the expiration of twenty-six years from the date of launch for vessels with an A1* or A1* certificate, twenty years for vessels with an A1 or A1 certificate, and eighteen years for vessels with an A or A certificate.

EXTRACTS FROM THE RULES of the late UNDERWRITERS' REGISTRY FOR IRON VESSELS (for 1884-85)

(NOW UNITED WITH LLOYD'S REGISTER OF SHIPPING).

EQUIPMENT FOR STEAM VESSELS.

Section 29.—The equipment of Anchors and Chain Cables and Hawsers to be in accordance with TABLE 14 for Steam Vessels (*see below*).

The tonnage regulating equipment is to be the gross register tonnage under upper deck, with the addition of three-tenths of the tonnage of erections above upper deck.

TABLE No. 14.—ANCHORS, CHAINS, AND HAWSERS FOR STEAM VESSELS.

VESSELS TONNAGE. *See Section 29.*	Anchors, with either Iron or Wood Stocks.								Stud-chain Cables.			Stream Chain.		Hawsers and Warps.				VESSELS TONNAGE. *See Section 29.*
	Number.			Weight.					Minimum Size.	Proved to Admiralty Test.	Length.			Tow Rope.	Hawsers.	Warps.	Length.	
	Bowers.	Stream.	Kedges.	Bowers. Without Stock.	Bowers. Admiralty Test.	Stream.	Kedge.	2nd Kedge.										
Tons.				Cwt.	Tons.	Cwt.	Cwt.	Cwt.	Inches.	Tons.	Fathoms.	Fath.	Size.	Inches.	Inches.	Inches.	Fath.	Tons.
100 and under 150	2	1	...	3	4·9	1	...	...	$1\frac{1}{16}$	8·1	120	45	$\frac{8}{16}$	$5\frac{1}{2}$	$3\frac{1}{2}$	...	90	100 and under 150
150 „ 188	2	1	1	4	6·4	$1\frac{3}{4}$	1	...	$1\frac{3}{16}$	11·9	150	45	$\frac{9}{16}$	6	4	...	90	150 „ 188
188 „ 225	2	1	1	$5\frac{1}{4}$	7·6	2	1	...	$1\frac{4}{16}$	13·8	165	45	$\frac{10}{16}$	6	4	...	90	188 „ 225
225 „ 263	2	1	1	6	8·2	$2\frac{1}{2}$	$1\frac{1}{4}$	...	$1\frac{5}{16}$	15·8	165	45	$\frac{10}{16}$	$6\frac{1}{2}$	4	...	90	225 „ 263
263 „ 300	2	1	1	$7\frac{1}{4}$	9·5	$2\frac{3}{4}$	$1\frac{1}{4}$	...	1	18	165	45	$\frac{11}{16}$	7	5	...	90	263 „ 300
300 „ 375	3	1	1	$8\frac{1}{4}$	10·4	3	$1\frac{1}{2}$	...	$1\frac{1}{16}$	20·3	165	60	$\frac{11}{16}$	$7\frac{1}{2}$	$5\frac{1}{2}$	...	90	300 „ 375
375 „ 450	3	1	2	10	12·0	$4\frac{3}{4}$	$2\frac{1}{4}$	1	$1\frac{2}{16}$	22·8	195	60	$\frac{12}{16}$	8	6	...	90	375 „ 450
450 „ 525	3	1	2	12	13·9	5	$2\frac{1}{2}$	$1\frac{1}{4}$	$1\frac{3}{16}$	25·4	195	60	$\frac{12}{16}$	$8\frac{1}{2}$	$6\frac{1}{2}$	...	90	450 „ 525
525 „ 600	3	1	2	$13\frac{1}{2}$	15·2	6	3	$1\frac{1}{2}$	$1\frac{4}{16}$	28·1	210	60	$\frac{13}{16}$	9	7	...	90	525 „ 600
600 „ 675	3	1	2	$15\frac{1}{4}$	16·7	$6\frac{1}{2}$	$3\frac{1}{4}$	$1\frac{3}{4}$	$1\frac{5}{16}$	31	210	60	$\frac{13}{16}$	$9\frac{1}{2}$	7	4	90	600 „ 675
675 „ 750	3	1	2	$16\frac{3}{4}$	18·0	7	$3\frac{1}{2}$	$1\frac{3}{4}$	$1\frac{6}{16}$	34	240	60	$\frac{14}{16}$	10	8	5	90	675 „ 750
750 „ 900	3	1	2	18	19·0	8	4	2	$1\frac{7}{16}$	37·2	240	60	$\frac{14}{16}$	10	8	5	90	750 „ 900
900 „ 1050	3	1	2	21	21·6	9	$4\frac{1}{2}$	$2\frac{1}{4}$	$1\frac{8}{16}$	40·5	240	75	$\frac{15}{16}$	10	9	$5\frac{1}{2}$	90	900 „ 1050
1050 „ 1200	3	1	2	$23\frac{1}{2}$	23·5	10	5	$2\frac{1}{2}$	$1\frac{9}{16}$	44	270	75	$\frac{15}{16}$	10	9	$5\frac{1}{2}$	90	1050 „ 1200
1200 „ 1350	3	1	2	$25\frac{1}{2}$	25·2	$10\frac{1}{2}$	$5\frac{1}{4}$	$2\frac{3}{4}$	$1\frac{10}{16}$	47·5	270	75	1	10	$9\frac{1}{2}$	6	90	1200 „ 1350
1350 „ 1500	3	1	2	$27\frac{3}{4}$	26·9	11	$5\frac{1}{2}$	$2\frac{3}{4}$	$1\frac{11}{16}$	51·2	270	75	1	10	10	6	90	1350 „ 1500
1500 „ 1800	3	1	2	30	28·6	12	6	3	$1\frac{12}{16}$	55·1	270	75	$1\frac{1}{16}$	11	$10\frac{1}{2}$	$6\frac{1}{2}$	90	1500 „ 1800
1800 „ 2100	3	1	2	32	30·1	13	$6\frac{1}{2}$	$3\frac{1}{4}$	$1\frac{13}{16}$	59·1	270	75	$1\frac{1}{16}$	11	11	7	90	1800 „ 2100
2100 „ 2400	3	1	2	34	31·6	$13\frac{1}{2}$	$6\frac{3}{4}$	$3\frac{1}{4}$	$1\frac{14}{16}$	63·3	270	75	$1\frac{2}{16}$	11	11	7	90	2100 „ 2400
2400 „ 2700	3	1	2	$36\frac{1}{2}$	33·4	14	7	$3\frac{1}{2}$	$1\frac{15}{16}$	67·6	270	90	$1\frac{2}{16}$	12	12	8	90	2400 „ 2700
2700 „ 3000	3	1	2	38	34·5	$14\frac{1}{2}$	$7\frac{1}{4}$	$3\frac{1}{2}$	2	72	270	90	$1\frac{3}{16}$	12	12	8	90	2700 „ 3000
3000 „ 3450	3	1	2	40	35·7	15	$7\frac{1}{2}$	$3\frac{3}{4}$	$2\frac{1}{16}$	76·6	270	90	$1\frac{3}{16}$	12	12	8	90	3000 „ 3450
3450 „ 3900	3	1	2	41	37·0	16	8	$4\frac{1}{4}$	$2\frac{2}{16}$	81·3	300	90	$1\frac{3}{16}$	12	12	8	90	3450 „ 3900
3900 „ 4500	4	1	2	43	38·0	$17\frac{1}{2}$	$8\frac{1}{2}$	$4\frac{1}{2}$	$2\frac{3}{16}$	86·1	300	90	$1\frac{4}{16}$	12	12	9	90	3900 „ 4500
4500 „ 5250	4	1	2	45	39·2	19	$9\frac{1}{2}$	$4\frac{3}{4}$	$2\frac{4}{16}$	91·1	330	90	$1\frac{4}{16}$	12	12	9	90	4500 „ 5250
5250 „ 6000	4	1	2	47	41	21	10	5	$2\frac{5}{16}$	96	330	90	$1\frac{5}{16}$	12	12	9	90	5250 „ 6000

Anchors and Chains to be tested to Admiralty proof. A reduction of 15 per cent. will be allowed in the weight of the Third and Fourth Bower.

LLOYD'S REGISTER OF SHIPPING.

STEEL MANUFACTURERS.

The following firms having applied to have the steel produced by them tested by a Surveyor to this Society and their mode of procedure reported upon, their applications have been complied with and the Surveyors' reports found satisfactory by the Committee.

Firms in the United Kingdom.

Acme Steel and Foundry Co., Shettleston, near Glasgow. (*Steel castings.*)

Allen, Edgar, & Co., Lim., Imperial Steel Works, Tinsley, Sheffield. (*Steel castings.*)

Armstrong (Sir W. G.), Whitworth & Co., Lim., Elswick, Northumberland (*Steel castings and Forgings*); and Openshaw, Manchester. (*Steel castings, forgings, and plates.*)

Atlas (The) Steel Foundry and Engineering Co., Lim., Armadale, West Lothian. (*Steel castings.*)

Baird, Archibald, & Son, Lim., Hamilton, near Glasgow. (*Steel castings.*)

Baker, John, & Co. (Rotherham) Lim., Kilnhurst Steel Works, near Rotherham. (*Steel ingots for forgings.*)

Baldwins, Lim., Elba Steel Works, Gowerton, Glamorganshire. (*Steel ingots, billets, and bars.*)

Barrow Hæmatite Steel Co., Lim., Barrow-in-Furness.

Bauly (H. C.), Lim., Dagenham Dock Steel Foundry & Engineering Works, Dagenham Dock, Essex (*Small steel castings.*)

Beardmore, William, & Co., Lim., Parkhead, Glasgow; and Mossend, Lanarkshire.

Bessemer, H., & Co., Lim., Bessemer Works, Sheffield, Yorkshire; and Bolton, Lancashire.

Beyer, Peacock & Co., Lim., Gorton Foundry, Manchester. (*Steel castings.*)

Blackett, Hutton & Co., Cleveland Steel and Iron Works, Guisborough, Yorkshire. (*Steel castings.*)

Bolckow, Vaughan & Co., Lim., Middlesbro'-on-Tees.

Braintree Castings Co., Chapel Hill Foundries, Braintree, Essex. (*Small steel castings.*)

British Mannesmann Tube Co., Lim., Landore, S. Wales. (*Weldless rolled or drawn steel hollow pillars and davits*

Briton Ferry Steel Co., Lim., Briton Ferry, Glamorganshire. (*Rivet bars only.*)

Brown, John, & Co., Lim., Sheffield; and Frodingham. (*Steel castings*).

Brown, Bayley's Steel Works, Lim., Sheffield. (*Steel ingots, forgings, and bars.*)

Brymbo (The) Steel & Ingot Iron Works, near Wrexham, Denbighshire. (*For bars only.*)

Butterley Co., Lim., Codnor Park, near Alfreton, Derbyshire.

Caledonian Steel Castings Co., Helen Street, Govan, Glasgow. (*Steel castings.*)

Cammell Laird & Co., Lim., Sheffield.

Cargo Fleet Iron Co., Lim., Cargo Fleet, near Middlesbro'-on-Tees. (*Sections and bars.*)

Carntyne Steel Castings Co., Moorpark, Renfrew. (*Steel castings.*)

Catton & Co., Lim., Yorkshire Steel Foundry, Hunslet, Leeds. (*Steel castings.*)

Clayton & Shuttleworth, Lim., Lincoln. (*Steel castings.*)

Clyde Alloy Steel Co., Ltd., Craigneuk Works, Flemington, Motherwell. (*Small steel castings*)

Coltness Iron Co., Lim., Newmains, Lanarkshire. (*Steel castings.*)

Colville, David, & Sons, Lim.,

Dalzell Steel and Iron Works, Motherwell, Lanarkshire.

Clydebridge Steel Works, Cambuslang, near Glasgow.

Glengarnock Iron and Steel Works, Glengarnock, Ayrshire. (*Sections and bars.*)

Consett Iron Co., Lim., Blackhill, Durham.

Cook, Joseph, Sons & Co., Lim., Washington Steel & Iron Works, Washington Station S.O., co. Durham. (*Steel castings.*)

Darlington Forge Co., Lim., Darlington. (*Steel castings.*)

Dorman, Long & Co., Lim., Middlesbro'-on-Tees; Port Clarence, co. Durham; and Redcar Iron and Steel Works, Redcar.

Dudley's (The Earl of) Round Oak Iron and Steel Works, Lim., Brierley Hill, Staffordshire (*Sections and bars.*)

Dunlop, J., & Co., Lim., Calderbank, Lanarkshire.

Firth, Thomas, & Sons, Lim., Norfolk Works, Sheffield.

Fox (Samuel) & Co., Lim., Stocksbridge Works, near Sheffield. (*Steel ingots.*)

Frodingham Iron & Steel Co., Lim., Scunthorpe, Lincs. (*Sections and bars.*)

Gilbertson, W., & Co., Lim., Pontardawe, Glamorgan. (*Steel ingots for forgings.*)

Glanmor Foundry Co., Llanelly. (*Steel castings.*)

Glasgow Iron & Steel Co., Lim., Wishaw, Lanarkshire.

Guest, Keen & Nettlefolds, Lim.,

Dowlais (Glamorgan) and Cardiff. (*Plates and bars.*)

Castle Works, Tydu, near Newport, Mon. (*Rivet and Stay bars.*)

London Works, near Birmingham. (*Rivet bars only.*)

Hadfield's Steel Foundry Co., Lim., Sheffield. (*Steel castings.*)

Harfield & Co., Blaydon-on-Tyne. (*Steel castings.*)

Head, Wrightson & Co., Lim., Thornaby-on-Tees. (*Steel castings.*)

Henderson (John M.) & Co., King's Works, Aberdeen. (*Steel castings and ingots.*)

Hickman (Alfred), Lim., Staffordshire Steel & Ingot Iron Works, Bilston, Staffordshire.

Holcroft's Steel Foundry Co., Ld., Bilston, Staffordshire. (*Steel castings.*)

Hopkinson, J., & Co., Lim., Britannia Works, Huddersfield, Yorkshire. (*Steel castings.*)

Jackson, P. R., & Co., Lim., Salford, Manchester. (*Steel castings.*)

Jenkins' (Philip) Sons, Lim., Excelsior Metal Works, Riverside, Neath, Glamorgan. (*Cast steel anchor heads.*)

Jessop, W., & Sons, Lim., Brightside Works, Sheffield.

Jonas, Colver & Co., Lim., Continental Steel Works, Sheffield. (*Steel ingots and forgings.*)

Jopling, E., & Sons, Pallion, Sunderland. (*Steel castings.*)

Kryn & Lahy Metal Works, Lim., Letchworth, Hertfordshire. (*Steel castings.*)

Lanarkshire Steel Co., Lim., Motherwell, Lanarkshire. (*Sections and bars.*)

Lancashire & Yorkshire Railway Co., Horwich, Lancashire. (*Steel castings.*)

Leeds Forge Co., Lim., Leeds.

Lilleshall Co., Lim., Priors Lee Hall, nr. Shifnal, Salop. (*Steel ingots.*)

Lloyd, F. H., & Co., Lim., James Bridge, near Wednesbury, Staffordshire. (*Steel castings.*)

London (The) Foundry Co., Lim., Brimsdown, Enfield Highway, Middlesex. (*Steel castings.*)

Lumb, James, & Sons, Lim., Elland, Yorkshire. (*Steel castings.*)

Monks, Hall & Co., Lim., Warrington. (*Rolling Mills for bars.*)

Motherwell Iron & Steel Co., Lim., Motherwell, Lanarkshire. (*Angles and bars.*)

National Steel Foundry (1914), Lim., (The), Kirkland Works, Leven, Fifeshire. (*Steel castings.*)

North British (The) Steel Foundry, Lim., Balbardie Steel Works, Bathgate. (*Small steel castings.*)

Osborn, S., & Co., Clyde Steel & Iron Works, Sheffield. (*Steel castings.*)

Palmers Shipbuilding & Iron Co., Lim., Jarrow-on-Tyne.

Park Gate Iron & Steel Co., Lim., Rotherham, Yorkshire.

Partington Steel & Iron Co., Irlam, Manchester. (*Billets, bars, and sections.*)

Patent Shaft & Axletree Co., Lim., Wednesbury, Staffordshire.

Pather Iron & Steel Co., Lim., Wishaw, Lanarkshire. (*Rolling Mills.*)

Port Talbot Steel Co., Lim., Port Talbot, South Wales.

Raine & Co., Lim., Delta Iron & Steel Works, Derwenthaugh, Newcastle-on-Tyne. (*Rivet bars only.*)

Redbourn Hill Iron & Coal Co., Lim., Frodingham, Lincolnshire. (*Steel ingots and billets.*)

Redheugh Iron & Steel Co., Lim., Teams, Gateshead-on-Tyne. (*Rolling Mills.*)

Renton & Fisher, Lim., Hopetoun Steel Works, Bathgate. (*Steel castings.*)

Richmond Iron & Steel Co., Richmond Iron Works, Stockton-on-Tees. (*Rolling Mills for stay and rivet bars.*)

Rogerson, John, & Co., Lim., Wolsingham, co. Durham. (*Steel castings.*)

Scottish Iron & Steel Co., Lim., Coatbridge, Lanarkshire. Waverley Works and North British Works (*Steel angles and bars*); Northburn Works (*Steel ingots and billets*).

Shaw, W., & Co., Middlesbro'-on-Tees. (*Steel castings.*)

Shelton Iron, Steel & Coal Co., Lim., Stoke-on-Trent.

Skinningrove Iron Co., Lim. (The), Skinningrove, Carlin How, R.S.O., Yorkshire. (*Sections and bars.*)

Smith & McLean, Lim., Mossend, and Gartcosh, Lanarkshire. (*Rolling Mills.*)

South Durham Steel & Iron Co., Lim., Stockton-on-Tees and West Hartlepool.

Spencer, John, & Sons, Lim., Newburn Steel Works, Newcastle-on-Tyne.

Springfield Steel Co., Lim., 777, London Road, Glasgow. (*Steel castings.*)

Steel Castings, Lim., Parkhead, Glasgow. (*Steel castings.*)

Steel Company of Scotland, Lim., Newton, Glasgow; and Blochairn, Glasgow.

Steel, Peech & Tozer, Lim., Sheffield. (*Rivet and stay bars.*)

Stewarts & Lloyds, Lim. (Clydesdale Steel and Iron Works), Mossend, Lanarkshire.

„ „ „ Sun Foundry, Coatbridge, Lanarkshire. (*Steel castings.*)

Stockton Steel Foundry Co., Lim., Stockton-on-Tees. (*Steel castings.*)

Summers, John, & Sons, Lim., Hawarden Bridge Steel Works, Shotton, Chester. (*Steel ingots and billets.*)

Summerson, Thomas, & Sons, Lim., Darlington. (*Small steel castings.*)

Taylor Bros., Leeds.

Tennent (R. B.), Lim., Whifflet Foundry, Coatbridge, Lanarkshire. (*Steel castings.*)

Thwaites Brothers, Lim., Bradford. (*Small steel castings.*)

Towler, William, & Co., Lim., Globe Foundry, Leeds. (*Small steel castings.*)

Tyne Electric Steel Foundries, Lim., Dunston-on-Tyne. (*Steel castings.*)

Tyzack, Samuel, & Co., Lim., Monkwearmouth Iron & Steel Works, Sunderland. (*Sections and bars.*)

Vickers, Lim., River Don Works, Sheffield; and Barrow-in-Furness.

Vickers-Petters, Lim., Ipswich Works, Ipswich. (*Steel castings.*)

Weldless (The) Steel Tube Co., Ld., Wednesfield, near Wolverhampton. (*Steel ingots for forgings.*)

Wigan Coal & Iron Co., Lim., Wigan, Lancashire. (*Sections and bars.*)

FIRMS IN COUNTRIES OTHER THAN THE UNITED KINGDOM.

ALPHABETICALLY ARRANGED.

In the following list the name of each works is followed by the place of residence of the Surveyor giving attendance thereat.

Acciaieria & Ferriere del Caleotto, Castello Sopra Lecco, Italy. (*Steel bars and small sections.*) (GENOA.)

Acciaieria Danieli & Co., Brescia, Italy. (*Steel castings.*) (GENOA.)

Acciaierie & Ferriere Lombarde; Head Office, Milan. (Works at Milan, *weldless rolled or drawn steel tubes and hollow pillars.*) (Works at Sesto S. Giovanni, *bars, sections, steel castings, and steel plates.*) (GENOA.)

Aciéries de Grenelle (E. Phchon), 56, Rue Lourmel, Paris. (*Steel castings.*) (PARIS.)

Aciéries de Maromme (E. Breton), Maromme (Seine Inférieure), France. (*Steel castings.*) (HAVRE.)

Aciéries de Mons, Nimy, Belgium. (*Small steel castings.*) (ANTWERP.)

Aciéries de Nanterre, Société Anonyme, Nanterre (Seine), France. (*Steel castings.*) (PARIS.)

Aciéries Réunies de Burbach-Eich-Dudelange (Arbed). Usines à Burbach, Saarbrucken-Burbach. (PARIS.)

Adirondacks Steel Foundries Corporation, Watervliet, N.Y., U.S.A. (*Steel castings.*) (NEW YORK.)

Aktiebolaget Bofors, Bofors, Sweden. (*Melting Furnaces and Foundry* at Bofors.) (GOTHENBURG.)

Alan Wood, Iron & Steel Company, Conshohocken and Ivy Rock, Pa., U.S.A. (*Blooms, billets and thin plates.*) (PHILADELPHIA.)

Algoma Steel Corporation, Lim., Sault St. Marie, Ontario, Canada. (*Steel billets, bars and angles.*) (TORONTO.)

Allegheny Steel Co., Brackenridge, Pa., U.S.A. (*Also steel castings.*) (PITTSBURGH.)

American Bridge Co., Pencoyd Iron Works, Pencoyd, Pa., U.S.A. (*Sections, angles and bars.*) (PHILADELPHIA.)

American Locomotive Co., Chester, Pa., U.S.A. (*Steel castings.*) (PHILADELPHIA.)

American Machine & Manufacturing Co., Atlanta, Ga., U.S.A. (*Steel castings.*) (BIRMINGHAM, ALA.)

American Manganese Steel Co., Newcastle, Del., U.S.A. (*Steel castings.*) (PHILADELPHIA.)

American Rolling Mill Co., Middletown, O., U.S.A. (*Steel castings and forgings.*) (CLEVELAND, O.)

American Steel & Wire Co. (Shoenberger Works), Fifteenth St., Pittsburgh, Pa., U.S.A. (*Steel ingots, etc.*) (PITTSBURGH.)

American Steel Foundries, Chester, Pa., U.S.A. (*Steel castings.*) (PHILADELPHIA.)

American Steel Foundries, Indiana Harbor, Ind., U.S.A. (*Steel castings.*) (CHICAGO.)

Andrews Steel Co., Newport, Kentucky, U.S.A. (*Ingots, blooms, billets and slabs.*) (CLEVELAND, O.)

Annener Gussstahlwerk Akt. Ges., Annen, near Dortmund, Westphalia, Germany. (*Steel castings.*) (DÜSSELDORF.)

Anniston Steel Co., Anniston, Ala., U.S.A. (*Steel castings and rivet bars.*) (BIRMINGHAM, ALA.)

Asano Kokura Steel Co., Lim., Konomimachi, Kokura, Japan. (*Ingots.*) (NAGASAKI.)

Asano Shipbuilding Co., Lim., Tsurumi, Japan. (*Rolling Mills for plates.*) (NAGASAKI.)

Atlantic Steel Castings Co., Chester, Pa., U.S.A. (*Steel castings.*) (PHILADELPHIA.)

Atlas Steel Casting Co., Buffalo, N.Y., U.S.A. (*Steel castings.*) (BUFFALO.)

Atlas-Werke Akt. Ges., Bremen. (*Steel castings.*) (BREMEN.)

Australian Electric Steel Co., Alexandria, Sydney, N.S.W. (*Steel castings.*) (SYDNEY, N.S.W.)

Avesta Jernverks Aktiebolag, Avesta, Sweden. (*Steel plates, sections, and high pressure air receivers.*) (STOCKHOLM.)

Bayonne Steel Casting Co., Bayonne, N.J., U.S.A. (*Steel castings.*) (NEW YORK.)

Bergische Stahl-Industrie G.m.b.H., Remscheid, Germany. (*Steel ingots and castings.*) (DÜSSELDORF.)

Best Steel Casting Co., San Francisco, Cal., U.S.A. (*Steel castings.*) (SAN FRANCISCO.)

Bethlehem Steel Co.,
Bethlehem, Pa., U.S.A. (PHILADELPHIA.)
Lebanon, Pa., U.S.A. (*Rolling Mills for bars.*) (BALTIMORE.)
Reading, Pa., U.S.A. (*Rolling Mills for bars.*) (PHILADELPHIA.)
Sparrow's Point, Md., U.S.A. (BALTIMORE.)
Steelton, Pa., U.S.A. (BALTIMORE.)

Birdsboro' Steel Foundry & Machine Co., Birdsboro', Pa., U.S.A. (*Steel castings and ingots.*) (PHILADELPHIA.)

Bismarckhütte, Abteilung Bochum, Bochum, Westphalia, Germany. (*Steel Foundry and Rolling Mills.*) (DÜSSELDORF.)

Bismarckhütte (Bismarckhütte & Falvahütte), Bismarckhütte, Oberschlesien, Germany. (*Also steel castings, and weldless rolled or drawn steel hollow pillars and davits.*) (VIENNA.)

Björneborgs Jernverks Aktiebolag, Björneborg, Sweden. (*Melting Furnaces and Forge.*) (GOTHENBURG.)

Blohm & Voss, Hamburg, Germany. (*Steel castings.*) (HAMBURG.)

Bochumer Verein für Bergbau & Gussstahlfabrikation, Bochum, Germany. (*Steel castings.*) (DÜSSELDORF.)

Böhler, Gebr., & Co., Akt. Ges., Vienna. (*Works* at Kapfenberg, Styria.) (*Steel castings.*) (VIENNA.)

Bonney-Floyd Co., Columbus, O., U.S.A. (*Steel castings.*) (COLUMBUS, O.)

Borsig, A. (Berg und Hütten-Verwaltung), Borsigwerk, Oberschlesien, Germany. (*Also steel castings.*) (VIENNA.)

Brier Hill Steel Co. (The), Youngstown, O., U.S.A. (PITTSBURGH.)

Broken Hill Proprietary Co., Lim., Iron and Steel Works, Newcastle, N.S.W. (*Steel plates, bars, sections and castings.*) (NEWCASTLE, N.S.W.)

Buhl Malleable Co., Detroit, Mich., U.S.A. (*Steel castings.*) (DETROIT.)

Bultfabriks Aktiebolaget, Hallstahammar, Sweden. (*Steel castings.*) (STOCKHOLM.)

Burmeister & Wain's Maskin-og Skibsbyggeri, Aktieselskabet, Copenhagen. (*Steel ingots, forgings and castings.*) (COPENHAGEN.)

Cambria Steel Co., Johnstown, Pa., U.S.A. (PITTSBURGH.)

Canadian Steel Foundries, Lim., Longue Pointe, Montreal. (*Steel castings.*) (MONTREAL.)

Canton Steel Foundry Co., Canton, O., U.S.A. (*Steel castings and ingots.*) (CLEVELAND, O.)

Carbon Steel Co., Pittsburgh, Pa., U.S.A. (PITTSBURGH.)

Carnegie Steel Co., Pittsburgh, Pa., U.S.A. (PITTSBURGH.)

Central Iron & Steel Co., Harrisburg, Pa., U.S.A. (*Rolling Mills.*) (BALTIMORE.)

Charlottenhütte Akt. Ges., Niederschelden (Kreis Siegen), Germany. (*Steel plates and ingots.*) (DÜSSELDORF.)

Chester Steel Castings Co., Chester, Pa., U.S.A. (*Steel castings.*) (PHILADELPHIA.)

Christiania Staalværk, Christiania. (*Steel castings.*) (CHRISTIANIA.)

Cleveland Steel Casting Co., Cleveland, O., U.S.A. (*Steel castings.*) (CLEVELAND, O.)

Colorado (The) Fuel & Iron Co., Minnequa Works, Pueblo, Colo. (*Bars and small sections.*) (CHICAGO.)

Columbia Steel Company, Pittsburgh, Cal., U.S.A. (*Steel castings.*) (SAN FRANCISCO.)

Columbia Steel Co., Portland, Or., U.S.A. (*Steel castings.*) (PORTLAND, OREGON.)

Commonwealth Government Naval Dockyard, Cockatoo, Sydney, N.S.W. (*Steel castings.*) (SYDNEY, N.S.W.)

Compagnie des Forges de Chatillon, Commentry et Neuves-Maisons, France. (MARSEILLES.)

Compagnie des Forges et Aciéries de la Marine et d'Homécourt, Le Boucau (Forges de l'Adour), (Basses-Pyrénées), France. (*Bars and sections.*) (BORDEAUX.)

Compagnie des Forges et Aciéries de la Marine et d'Homécourt, St. Chamond (Loire), France. (MARSEILLES.)

Compagnie des Mines, Fonderies & Forges d'Alais, Tamaris Works, Alais, France. (*Bars and sections.*) (MARSEILLES.)

Compagnie Générale des Aciers, Société Anonyme, Thy-le-Chateau, Belgium. (*Steel castings.*) (ANTWERP.)

Compañia Anonima Basconia, Bilbao, Spain. (BILBAO.)

Corrigan, McKinney & Co., Cleveland, O., U.S.A. (*Steel ingots, blooms and billets.*) (CLEVELAND, O.)

Crucible Steel Castings Co., Landsdowne, Pa., U.S.A. (*Steel castings.*) (PHILADELPHIA.)

Crucible Steel Company of America, Park Works, Pittsburgh, Pa., U.S.A. (PITTSBURGH.)

Cumming (J. W.) Manufacturing Co., Lim., New Glasgow, Nova Scotia. (*Small steel castings.*) (HALIFAX, N.S.)

Detroit Steel Casting Co., Detroit, Mich., U.S.A. (*Steel castings.*) (DETROIT.)

Deutsch Luxemburgische Bergwerks-und Hütten-Act. Ges., Abteilung Dortmunder Union, Dortmund, Germany. (*Also Steel castings.*) (DÜSSELDORF.)

Dillinger Hüttenwerke Akt. Ges., Dillingen-Saar. (PARIS.)

Dominion Iron & Steel Co., Lim., Sydney, Nova Scotia. (*Steel ingots, billets, plates and sections.*) (HALIFAX, N.S.)

Dominion Steel Foundry Co., Lim., Hamilton, Ontario. (*Steel castings.*) (TORONTO.)

Donner Steel Co., Inc. (The), Buffalo, N.Y., U.S.A. (BUFFALO.)

Drain Steel Co., Moore, Pa., U.S.A. (*Steel ingots.*) (PHILADELPHIA.)

Düsseldorfer Eisen-und Draht-Industrie, Düsseldorf-Oberbilk, Germany. (*Bars and sections only.*) DÜSSELDORF.)

Eagan-Rogers Steel & Iron Co., Inc., Crum Lynne, Pa., U.S.A. (*Small steel castings.*) (PHILADELPHIA.)

Eastern Steel Co., Pottsville, Pa., U.S.A. (*Sections and bars.*) (PHILADELPHIA.)

Eichener Walzwerk und Verzinkerei Akt. Ges., Kreuztal, near Siegen, Germany. (*Rolling Mills.*) (DÜSSELDORF.)

Eisen-und Stahlwerk Hoesch, Dortmund, Germany. (*Rolling Mills.*) (DÜSSELDORF.)

Eisenhütte Holstein Act. Ges., Rendsburg, Germany. (HAMBURG.)

Eisenwerk Kraft Act. Ges., Abteilung Niederrheinische Hütte, Duisburg-Hochfeld, Germany. (DÜSSELDORF.)

Electric Steel & Metals Co., Lim., Welland, Ontario. (*Steel ingots and steel castings.*) (BUFFALO.)

Electric Steel Foundry, Portland, Or., U.S.A. (*Steel castings.*) (PORTLAND, OREGON.)

Erie Forge Co., Erie, Pa., U.S.A. (*Steel ingots and forgings.*) (CLEVELAND, O.)

Fagersta Bruks Aktiebolag, Fagersta, Sweden. (*Steel blooms and billets.*) (STOCKHOLM.)

Falk Company, Milwaukee, Wis., U.S.A. (*Steel castings.*) (CHICAGO.)

Federal Steel Foundry Co., Chester, Pa., U.S.A. (*Steel castings.*) (PHILADELPHIA.)

Ferriera di Bolzaneto, near Genoa. (*For plates up to $\frac{3}{4}$ in. thickness.*) (GENOA.)

Ferriere di Voltri, Voltri, Italy. (*Small sections, angles and bars.*) (GENOA.)

Ferriere ed Acciaierie del Vesuvio, Torre Annunziata, Naples. (*Rolling Mills for sections and bars.*) (NAPLES.)

Fonderia Milanese di Acciaio, Milan. (*Steel castings.*) (GENOA.)

Fonderies, Forges et Aciéries de St. Etienne, St. Etienne, France. (MARSEILLES.)

Fonderies d'Acier du Midi, Marseilles. (*Steel castings*), (MARSEILLES.)

Forged Steel Wheel Company, Butler, Pa., U.S.A. (PITTSBURGH.)

Forges de la Loire et du Midi (Messrs. Marrel Frères), Rive de Gier, France. (MARSEILLES.)

Forsbacka Jernverks Aktiebolag, Forsbacka, Sweden. (*Steel blooms, billets, tubes, and forged and rolled bars.*) (STOCKHOLM.)

Ganz & Co., Danubius Ratibor, Silesia, Germany. (*Steel castings.*) (VIENNA.)

Geisweider Eisenwerke Act. Ges., Geisweid (Kreis Siegen), Germany. (*Rolling Mills.*) (DÜSSELDORF.)

Gelsenkirchener Gusstahl und Eisenwerke, Gelsenkirchen, Germany. (*Steel castings.*) (DÜSSELDORF.)

Gelsenkirchener Gusstahl und Eisenwerke, Abteilung Hagener Gusstahlwerke, Hagen, Westphalia, Germany. (*Steel castings and forgings.*) (DÜSSELDORF.)

Gelsenkirchener Gusstahl und Eisenwerke, Abteilung Stahlwerke Krieger, Düsseldorf-Oberkassel, Germany. (*Steel castings.*) (DÜSSELDORF.)

Georgs-Marien Bergwerks-und Hütten-Verein Act. Ges., Osnabrück, Germany. (*Steel castings.*) (DÜSSELDORF.)

Glasgow Iron Co., Pottstown, Pa., U.S.A. (*Rolling Mills for plates.*) (PHILADELPHIA.)

Gould-Coupler Co., Depew, N.Y., U.S.A. (*Steel ingots.*) (BUFFALO.)

Grafenberger Walzwerk G.m.b.H., Düsseldorf-Grafenberg, Germany. (*Rolling Mills.*) (DÜSSELDORF.)

Gruson (Otto) & Co., Eisen und Stahlwerk, Magdeburg-Buckau, Germany. (*Steel castings.*) (DÜSSELDORF.)

Gulf States Steel Co., Alabama City, Ala., U.S.A. (*Rivet and stay bars up to 2½ ins. diameter.*) (BIRMINGHAM, ALA.)

Gusstahl-Werk Witten, Witten a/d Ruhr, Germany. (DÜSSELDORF.)

Gutehoffnungshütte, Oberhausen, Rheinland, Germany. (*Also Steel castings.*) (DÜSSELDORF.)

Gutehoffnungshütte, Abteilung Haniel & Lueg, Düsseldorf-Grafenberg, Germany. (*Steel castings.*) (DÜSSELDORF.)

Hahnsche Werke Act. Ges., Grossenbaum, near Duisburg, Germany. (*Broad flats and ingots.*) (DÜSSELDORF.)

Han-Yeh-Ping Iron & Coal Co., Lim., Hanyang, China. (HANKOW.)

Hasper Eisen-und Stahlwerk, Haspe, Westphalia, Germany. (*Rolling Mills.*) (DÜSSELDORF.)

Hauts-Fourneaux Fonderies, Forges & Laminoirs de Meurthe & Moselle (Mr. Fould-Dupont), Usines de Pompey, France. (PARIS).

Henschel & Sohn, Abteilung Henrichshütte, near Hattingen a/d Ruhr, Germany. (DÜSSELDORF.)

Hercules Steel Castings Co., Milwaukee, Wis., U.S.A. (*Steel castings.*) (CHICAGO.)

Holtzer, Jacob, & Co., Aciéries d'Unieux, Unieux (Loire), France. (*Steel castings.*) (MARSEILLES.)

Hoopes & Townsend Co., Philadelphia, Pa., U.S.A. (*Rolling Mills for bars* at Fort Washington, Pa.) (PHILADELPHIA.)

Howaldtswerke, Kiel, Germany. (*Steel castings.*) (HAMBURG.)

Hubbard Steel Foundry Co., East Chicago, Ind., U.S.A. (*Steel castings.*) (CHICAGO.)

Huntington Steel Co., Huntington, Ind., U.S.A. (*Steel castings.*) (CHICAGO.)

Hüttengesellschaft der Rothen Erden, Aachen Rothe Erde, Germany. (*Rolling Mills.*) DÜSSELDORF.)

Illinois Steel Co., Chicago, Ill., U.S.A. (CHICAGO.)

Ilva Alti Forni e Acciaierie d'Italia, Genoa.
Stabilimento di Pra, Pra.
Stabilimento di Bolzaneto, Bolzaneto.
Stabilimento di Sestri Ponente, Sestri Ponente.
Stabilimento di Savona, Savona.

Imperial Steel Works (The), Yawata, Japan. (NAGASAKI.)

Inland Steel Co. (*Steel Works* at Indiana Harbor, Ind., U.S.A., and *Rolling Mills* at Chicago Heights, Chicago, Ill., U.S.A.) (CHICAGO.)

Interstate Iron and Steel Co., Chicago, Ill., U.S.A. (*Steel Works* at 118th Street, Chicago, and *Rolling Mills* at East Chicago, Ind.) (*Steel angles and bars.*) (CHICAGO.)

Jaeger, G. & J., Kommandit Ges., Elberfeld, Germany. (*Steel castings.*) (DÜSSELDORF.)

Japan Steel Works, Lim. (The), Muroran, Japan. (*Steel ingots, forgings and castings.*) (HAKODATE.)

Jones & Laughlin Steel Company, Pittsburgh, Pa., U.S.A. (PITTSBURGH.)

Judson Manufacturing Co., Emeryville, Alameda Co., U.S.A. (*Steel ingots.*) (SAN FRANCISCO.)

Kawasaki Dockyard Co., Lim. (Fukiai Works), Kobe, Japan. (KOBE.)

Kawasaki Dockyard Co., Lim., Shiri-ike-mura, Hiogo, Japan. (*Steel castings, forgings, bars and sections.*) (KOBE.)

Kobe Steel Works, Lim., Kobe, Japan. (*Steel castings, forgings, and plain and angle bars of small section.*) (KOBE.)

Kohlswa Jernverks Aktiebolag. (*Melting Furnaces, Foundry and Forge* at Kohlswa, Sweden.) (STOCKHOLM.)

Königs und Laurahütte, Vereinigte Akt. Ges., für Bergbau und Hüttenbetrieb, Konigshütte & Laurahütte, Oberschlesien, Germany. (VIENNA.)

Krainische Industrie-Gesellschaft, Assling-Hütte, Carniole, Jugo-Slavia. (TRIESTE.)

Krainische Industrie-Gesellschaft, Servola, near Trieste, (TRIESTE.)

Krupp, Fried., Act. Ges., Stahlwerk Annen in Annen, Westphalia, Germany. (*Steel castings.*) (DÜSSELDORF.)

Krupp, Fried., Act. Ges., Essen, Germany. (*Also Steel castings.*) (DÜSSELDORF.)

Krupp, Fried., Act. Ges., Grusonwerk, Magdeburg, Germany. (*Steel castings.*) (DÜSSELDORF.)

Krupp, Fried., Act. Ges.—Friedrich Alfred Hütte, Rheinhausen—Friemersheim, Germany. (*Bars and sections only.*) (DÜSSELDORF.)

La Belle Iron Works, Steubenville, O., U.S.A. (PITTSBURGH.)

Lackawanna Steel Co., Buffalo, N.Y., U.S.A. (BUFFALO.)

Latorps Bruk, Finspong, Sweden. (*Managers*, Kohlswa Jernverks Aktiebolag.) (*Melting Furnaces and Forge.*) (STOCKHOLM.)

Lauchhammer Akt. Ges., Abteilung Stahlwerk Torgau, Torgau, Germany. (*Steel castings.*) (DÜSSELDORF.)

Lauchhammer Akt. Ges., Abteilung Stahl and Walzwerk Riesa, Riesa, Germany. (*Rolling Mills.*) (DÜSSELDORF.)

Lauchhammer Akt. Ges., Lauchhammer, Germany. (*Steel Foundry* at Gröditz.) (*Steel castings.*) (DÜSSELDORF.)

Lindener Eisen & Stahlwerke Akt. Ges., Hannover-Linden, Germany. (*Steel castings.*) (DÜSSELDORF.)

Lithgow Iron & Steel Works, Lithgow, N.S.W. (*Bars and sections.*) (SYDNEY, N.S.W.)

Llewellyn Iron Works, Torrance, Cal., U.S.A. (*Round bars, small sections, also steel castings.*) (SAN FRANCISCO.)

Luken's Iron and Steel Company, Coatesville, Pa., U.S.A. (PHILADELPHIA.)

Machine Fabriek Yzer-Staal & Metaal Gieterij (v/h Bakker & Co.), Ridderkerk. (*Steel castings.*) (ROTTERDAM.)

Malleable Iron Fittings Co., Branford, Conn. (*Steel castings.*) (NEW YORK.)

Mannesmannröhrenwerke, Abteilung Grillo Funke, Gelsenkirchen-Schalke, Westphalia, Germany. (DÜSSELDORF.)

Mannesmannröhrenwerke, Abteilung Saarbrücker Guss stahlwerke, Saarbrücken-Burbach. (*Steel castings.*) (PARIS.)

Mannesmannröhrenwerke, Abteilung Schulz Knaudt, Hückingen, Germany. (*Steel Works and Rolling Mills.*) (DÜSSELDORF.)

Mannesmannröhrenwerke, Bous. (PARIS.)

Mannesmannröhrenwerke, Düsseldorf und Remscheid, Germany. (*Weldless rolled or drawn steel hollow pillars and davits.*) (DÜSSELDORF.)

Maynard Electric Steel Castings Co., Milwaukee, Wisconsin, U.S.A. (*Steel castings.*) (CHICAGO.)

Michaelsen, Hermann, Eisen-und Stahl-Giesserei, Erdmannstrasse, 23, Altona-Ottensen, Germany. (*Steel castings.*) (HAMBURG.)

Midvale Steel & Ordnance Company, Philadelphia, Pa., U.S.A. (PHILADELPHIA.)
Coatesville, Pa., U.S.A. (PHILADELPHIA.)

Mitsu Bishi Dockyard & Engine Works, Nagasaki, Japan. (*Steel castings.*) (NAGASAKI.)

Mitsu Bishi Seitetsu Kabushiki Kaisha, Kenjiho, Korea. (KENJIHO.)

Mitsubishi Zosen Kaisha, Nagasaki Steel Works, Urakami, Nagasaki, Japan. (*Steel ingots, blooms and forgings.*) (NAGASAKI.)

Monarch Steel Castings Co., Detroit, Mich., U.S.A. (*Steel castings.*) (DETROIT.)

Motala Verkstads Nya Aktiebolag, Motala Verkstad, Sweden. (*Melting Furnaces, Rolling Mills and Forge.*) (GOTHENBURG.)

Nagle Steel Co., Pottstown, Pa., U.S.A. (PHILADELPHIA.)

National Enameling & Stamping Co., Granite City, Ill., U.S.A. (CHICAGO.)

National Foundry Co., Erie, Pa., U.S.A. (*Steel castings.*) (CLEVELAND, O.)

National Malleable Castings Co., Sharon, Pa., U.S.A. (*Steel ingots.*) (PITTSBURGH.); and Melrose Park, Chicago, Ill., U.S.A. (*Steel ingots.*) (CHICAGO.)

National Steel Foundries Co., Milwaukee, Wis., U.S.A. (*Steel castings.*) (CHICAGO.)

National Tube Co., Lorain, O., U.S.A. (*Blooms, billets and plates.*) (CLEVELAND, O.)

Nederlandsche Staalfabrieken (v/h J. M. de Muinck Keizer), Utrecht, Holland. (*Steel castings.*) (ROTTERDAM.)

New Jersey Steel Co., Rahway, N.J., U.S.A. (*Steel castings.*) (NEW YORK.)

Nippon Kokan Kabushiki Kaisha, Kawasaki, Japan. (*Steel tubes, bars and sections.*) (YOKOHAMA.)

Northwestern Steel & Iron Corporation, Minneapolis, Minn., U.S.A. (*Steel castings.*) (DULUTH, MINN.)

Nova Scotia Steel & Coal Co., Lim. (*Steel Works* at North Sydney, C.B., and *Rolling Mills* at New Glasgow, N.S.) (*Bars and sections only.*) (HALIFAX, N.S.)

Nydqvist & Holm Aktiebolag, Trollhättan, Sweden. (*Steel castings.*) (GOTHENBURG.)

Oberbilker Stahlwerk Act. Ges., Düsseldorf-Oberbilk, Germany. (DÜSSELDORF.)

Oberschlesiche Eisen-Industrie Act. Ges., Baildonhütte, near Kattowitz, Germany. (VIENNA.)

Oberschlesiche Eisenbahn-Bedarfs Akt. Ges., Gleiwitz, Oberschlesien, Germany. (*Works* at Friedenshütte in Friedenshütte.) (VIENNA.)

Oesterreichisch-Alpine Montangesellschaft, Friedrichstrasse, 4, Vienna, I. (*Works* at Donawitz, near Leoben, Neuberg, and Zeltweg, Styria, Deutsch-Oesterreich.) (VIENNA.)

Oesterreichische Berg und Hüttenwerks Gesellschaft, Teschen, Silesia. (*Works* at Trzynietz and Karlshütte.) (PRAGUE.)

Ohio Steel Foundry Co., Lima, O., U.S.A. (CLEVELAND, O.)

Oliver Iron & Steel Co., Pittsburgh, Pa., U.S.A. (*Rolling Mills for bars.*) (PITTSBURGH.)

Olympic Steel Works, Seattle, Wash., U.S.A. (*Steel castings.*) (SEATTLE, WASH.)

Oshima Steel Works, Oshima, Tokio, Japan. (*Steel castings and forgings.*) (YOKOHAMA.)

Otis Elevator Co., Buffalo, N.Y., U.S.A. (*Steel castings.*) (BUFFALO.)

Otis Steel Co. (The), Cleveland, O., U.S.A. (CLEVELAND, O.)

Pacific Coast Steel Co., Seattle, Wash., U.S.A. (*Sections and bars.*) (SEATTLE.)

Pacific Coast Steel Co., South San Francisco, Cal., U.S.A. (*Steel ingots, small sections and bars.*) (SAN FRANCISCO.)

Panzer Akt. Ges., Gussstahlwerk, Wolgast, Germany. (*Small steel castings.*) (DÜSSELDORF.)

Pelton Steel Co., Milwaukee, Wis., U.S.A. (*Steel castings.*) (CHICAGO.)

Penn Seaboard Steel Corporation, Newcastle, Delaware, U.S.A.; Chester, Pa., U.S.A. (*Steel castings.*) (PHILADELPHIA.)

Pennsylvania Forge Co., Bridesburg, Philadelphia, Pa., U.S.A. (*Steel ingots and forgings.*) (PHILADELPHIA.)

Philadelphia Roll & Machine Co., Philadelphia, Pa., U.S.A. (*Steel castings.*) (PHILADELPHIA.)

"Phœnix" Act. Ges. für Bergbau-und Hütten Betrieb, Ruhrort, Germany. (*Bars and sections only.*) (DÜSSELDORF.)

"Phœnix" Act. Ges. für Bergbau-und Hütten Betrieb, Abteilung Düsseldorfer Röhren und Eisen-Walzwerke, Düsseldorf-Oberbilk, Germany. (DÜSSELDORF.)

"Phœnix" Act. Ges. für Bergbau-und Hütten Betrieb. Abteilung Hoerder Verein, Hoerde, Westphalia, Germany. (*Also Steel castings.*) (DÜSSELDORF.)

Phœnix Iron Works, Phœnixville, Pa., U.S.A. (PHILADELPHIA.)

Phönix Stahlwerke Joh. E. Bleckmann, Mürzzuschlag, Deutsch-Oesterreich. (*Steel bars.*) (VIENNA.)

Pittsburgh Crucible Steel Co., Midland, Pa., U.S.A. (PITTSBURGH.)

Pittsburgh Steel Foundry, Glassport, Pa., U.S.A. (*Steel castings and ingots.*) (PITTSBURGH.)

Poldihütte Tiegelguss-Stahlfabrik, Kladno, near Prague. (PRAGUE.)

Prazska zelezarska spolecnost, Kladno, near Prague. (PRAGUE.)

Puget Sound Steel Works, Tacoma, Wash., U.S.A. (*Steel castings.*) (SEATTLE.)

Reading Steel Casting Co., Reading, Pa., U.S.A. (*Small steel castings.*) (PHILADELPHIA.)

Republic Iron & Steel Co., Youngstown, O., U.S.A. (PITTSBURGH.)

Rheinische Stahlwerke, Duisburg-Meiderich, Germany. (*Bars and sections only.*) (DÜSSELDORF.)

Rheinische Stahlwerke, Abtielung Duisburger Eisen-und Stahlwerke, Duisburg, Germany. (DÜSSELDORF.)

Rimamurany-Salgo-Tarjaner Eisenwerks Act. Ges., Budapest. (*Steel Works* in Ozd, Hungary.) (VIENNA.)

Riverside Steel Casting Co., Kearny, N.J., U.S.A. (*Steel castings.*) (NEW YORK.)

Ruwolt (Charles) Proprietary, Lim., Richmond, Melbourne. (*Steel castings.*) (MELBOURNE.)

S.A.I. Gio. Ansaldo & Co., Fonderie & Acciaierie, Cornigliano Ligure, Italy. (*Steel castings.*) (GENOA.)

S. A. I. Gio. Ansaldo & Co., Stabilimenti Elettrosiderurgici, Aosta, Italy. (GENOA.)

Sandvikens Jernverks Aktiebolag, Sandviken, Sweden. (*Steel ingots, forgings, and steel tubes.*) (STOCKHOLM.)

Schichau, F., Elbing, West Prussia, Germany. (*Steel castings.*) (DANZIG.)

Schneider & Co., Creusot. (MARSEILLES.)

Scullin Steel Co., St. Louis, Mo., U.S.A. (*Steel castings.*) (CHICAGO.)

Sharon Steel Hoop Co., Youngstown, O., U.S.A. (*Steel melting plant* at Lowellville, O.; and *Rolling mills at* Youngstown, O.) (PITTSBURGH.)

Sizer Forge Company, Buffalo, N.Y., U.S.A. (*Ingots and forgings.*) (BUFFALO.)

Smedjebackens Valsverks Aktiebolaget, Smedjebacken, Sweden. (*Steel sections and castings.*) (STOCKHOLM.)

Sociedad Altos Hornos de Vizcaya, Bilbao. (BILBAO.)

Sociedad Anonima Aceros de Elorrieta, Bilbao. (*Steel castings.*) (BILBAO.)

Sociedad Anonima Fabrica de Mieres, Ablaña, Asturias, Spain. (BILBAO.)

Sociedad Anonima Fabrica de San Francisco del Desierto Bilbao. (BILBAO.)

Sociedad Anonima Industrial Asturiana, Fabricas de Moreda y Gijon, Gijon. (*Rivet bars.*) (BILBAO.)

Sociedad Anonima Jose Maria Quijano, Forjas de Los Corrales de Buelna, Provincia de Santander, Spain. (*Steel bars.*) (BILBAO.)

Sociedad Anonima Talleres de Deusto, Deusto, Bilbao. (*Steel castings.*) (BILBAO.)

Sociedad Española de Construccion Naval, Reinosa, near Santander, Spain. (*Steel castings and forgings.*) (BILBAO.)

Sociedad Metalurgica Duro-Felguera, La Felguera, Asturias, Spain. (BILBAO.)

Società Alti Forni, Fonderie, Acciaierie e Ferriere Franchi-Gregorini, Forno d'Allione (Val Camonica), Italy. (*Steel ingots.*) (GENOA.)

Società Alti Forni e Acciaierie d'Italia, Porto Vecchio di Piombino, Italy. (*Sections and bars.*) (GENOA.)

Società Alti Forni, Fonderie, Acciaierie e Ferriere Franchi-Gregorini, Lovere, Italy. (*Bars and sections, castings and forgings.*) (GENOA.)

Società Anonima Ferriere di Voltri, Stabilimenti di Oneglia e Portomaurizio, Oneglia, Italy. (*Sections and bars.*) (GENOA.)

Società Anonima Italiana Tubi Togni, Cogoleto, Ligure, Italy. (*Welded tubes, masts and pillars.*) (GENOA.)

Società degli Alti Forni, Fonderie ed Acciaierie di Terni. (*Works* at Terni.) (NAPLES.)

Società Ilva Bagnoli, Bagnoli, Naples. (*Sections and bars.*) (NAPLES.)

Società Italiana Ernesto Breda, Sesto S. Giovanni, Milan, Italy. (*Sections, forgings, and castings.*) (GENOA.)

Société Anonyme d'Athus-Grivegnée, Grivegnée, near Liége, Belgium. (ANTWERP.)

Société Anonyme d'Escaut & Meuse, Anzin (Nord), France. (PARIS.)

Société Anonyme de la Fabrique de Fer de Charleroi, Charleroi, Belgium. (ANTWERP.)

Société Anonyme des Aciéries et Fonderies d'Art de Haine St. Pierre et Métallurgique Lilloise, Haine St. Pierre, Belgium. (*Steel castings.*) (ANTWERP.)

Société Anonyme des Aciéries & Forges de Firminy, Firminy (Loire), France. (*Steel castings.*) (MARSEILLES.)

Société Anonyme des Aciéries ci-devant Georges Fischer, Schaffhouse, Switzerland. (*Steel castings.*) (WINTERTHUR.)

Société Anonyme des Aciéries d'Angleur, Renory & Tilleur-lez-Liége, Belgium. (ANTWERP.)

Société Anonyme des Aciéries Nantaises, Nantes. (*Steel castings.*) (NANTES.)

Société Anonyme des Fonderies et Aciéries de Hirson, Hirson, France. (*Steel castings.*) (PARIS.)

Société Anonyme des Forges de Vireux-Molhain, Vireux-Molhain, Ardennes, France. (*Bars and sections only.*) (ANTWERP.)

Société Anonyme des Forges et Aciéries de Huta Bankowa, Dombrowa, Poland. (*Steel plates, sections and castings.*) (VIENNA.)

Société Anonyme des Forges et Fonderies de Montataire, Montataire, France. (PARIS.)

Société Anonyme des Forges et Laminoirs de Baume, Haine St. Pierre, Belgium. (*Rolling Mills for bars and sections.*) (ANTWERP.)

Société Anonyme des Forges et Tôleries Liégeoises, Jupille-lez-Liége. (ANTWERP.)

Société Anonyme des Forges, Usines & Fonderies de Haine St. Pierre, Haine St. Pierre, Belgium. (*Steel castings.*) (ANTWERP.)

Société Anonyme des Hauts-Fourneaux, Fonderies & Forges de Franche-Comté, Besançon (Doubs), France. (MARSEILLES.)

Société Anonyme des Usines Gilson, La Croyère (Bois d'Haine), Belgium. (*Rolling Mills for sections.*) (ANTWERP.)

Société Anonyme d'Ougrée-Marihaye, Ougrée, near Liége, Belgium. (ANTWERP.)

Société Anonyme John Cockerill, Seraing, Belgium. (ANTWERP.)

Société Anonyme Usines & Aciéries Leonard-Giot, Marchienne-au-Pont, Belgium. (*Steel castings.*) (ANTWERP.)

Société des Aciéries de Longwy, Mont St. Martin (Meurthe & Moselle), France. (PARIS.)

Société Lorraine des Aciéries de Rombas, Rombas. (PARIS.)

Société Normande de Métallurgie, Mondeville (Calvados), France. (CAEN.)

Sosnowicer Röhrenwalzwerke und Eisenwerke, Warsaw and Zawiercie, Poland. (*Works* at Sosnowice, Poland.) (*Plates, bars and sections; seamless and welded tubes.*) (VIENNA.)

Southern California Iron and Steel Co., Los Angeles, Cal., U.S.A. (*Round bars.*) (SAN FRANCISCO.)

Stabilimenti di Dalmine, Società Anonima, Dalmine (Bergamo). (*Weldless rolled or drawn steel tubes, hollow pillars and davits.*) (GENOA.)

Stahlwerk Gebr. Boehler, Akt. Ges., Düsseldorf-Oberkassel. (*Ingots for steel forgings.*) (DÜSSELDORF.)

Stahlwerk "Mark" Act. Ges., Wengern-Ruhr, Germany. (*Steel castings.*) (DÜSSELDORF.)

Stahlwerk Oeking Act. Ges., Düsseldorf-Lierenfeld, Germany. (*Steel castings.*) (DÜSSELDORF.)

Statni Zelezarny Ceskoslovenske republiky v Podbrezove. (VIENNA.)

Stavanger Electro-Staalverk A.S., Stavanger, Norway. (*Steel castings.*) (CHRISTIANIA).

Steel & Tube Co. of America, Mark Plant, Indiana Harbor, Ind., U.S.A. (CHICAGO.)

Steel Company of Australia, Brunswick, Melbourne. (*Cast steel anchors.*) (MELBOURNE.)

Steel Company of Canada, Hamilton, Ontario. (*Works* at Hamilton and Belleville.) (TORONTO.) (*Works* at Montreal.) (MONTREAL.) (*Bars and angles.*)

Steirische Gusstahlwerke Act. Ges., Judenburg, Styria, Deutsch-Oesterreich. (*Steel castings.*) (VIENNA.)

Sterling Steel Foundry Co., Braddock, Pa., U.S.A. (*Steel castings.*) (PITTSBURGH.)

Stora Kopparbergs Bergslags Aktiebolag, Falun, Sweden. (*Steel Works* at Domnarfvet.) (*Sections of all sizes and plates up to $\frac{3}{4}$ in. thick.*) (STOCKHOLM.)

Störch & Schöneberg Akt. Ges. für Bergbau & Hüttenbetrieb, Weidenau-Sieg, Abteilung Bremerhütte, Geisweid, Germany. (*Steel plates and ingots.*) (DÜSSELDORF.)

Strömmens Verksted, near Christiania. (*Steel castings.*) (CHRISTIANIA.)

Strömsnäs Jernverks Aktiebolag, Degerfors, Sweden. (*Melting Furnaces and Rolling Mills.*) (GOTHENBURG.)

Strong Steel Foundry Co., Buffalo, N.Y., U.S.A. (*Steel castings.*) (BUFFALO.)

Sulzer Frères, Société Anonyme, Winterthur, Switzerland. (*Steel castings.*) (WINTERTHUR.)

Sumitomo Steel Works, Osaka, Japan. (*Steel castings and forgings.*) (KOBE.)

Surahammars Bruks Aktiebolag, Surahammar, Sweden. (*Forge and Rolling Mills.*) (STOCKHOLM.)

Tata Iron & Steel Co., Lim., Sakchi, India. (*Angles and channels.*) (CALCUTTA.)

Taylor-Wharton Iron & Steel Co., High Bridge, N.J., U.S.A. (*Steel castings.*) (NEW YORK.)

Tennessee Coal, Iron & Railroad Co., Birmingham, Ala., U.S.A. (*Steel Works* at Ensley, Ala., and *Rolling Mills* at Bessemer, Ala.) (BIRMINGHAM, ALA.)

Ternitzer Stahl und Eisenwerke von Schoeller & Co., Ternitz, Austria. (*Steel bars and castings.*) (VIENNA.)

Thomas Davidson Manufacturing Co. (The), Lim., Turcot, Montreal, Canada. (*Steel castings.*) (MONTREAL.)

Thyssen & Co., Mülheim a/d. Ruhr, Germany. (DÜSSELDORF.)

Thyssen (August), Hütte Gewerkschaft, Hamborn-Bruckhausen am Rhein, Germany. (*Bars and sections only.*) (DÜSSELDORF.)

Tindell Morris Company, Eddystone, Pa., U.S.A. (*Steel ingots and forgings.*) (PHILADELPHIA.)

Toledo Steel Casting Co., Toledo, O., U.S.A. (*Steel castings.*) (DETROIT.)

Treadwell Engineering Co., Easton, Pa., U.S.A. (*Steel castings.*) (PHILADELPHIA.)

Tremont Nail Co. (The), West Wareham, Mass., U.S.A. (*Steel ingots and forging billets.*) (BOSTON.)

Twin City Forge & Foundry Co., Stillwater, Minnesota, U.S.A. (*Steel castings.*) (DULUTH, MINN.)

Union Steel Casting Co., Boston, Mass., U.S.A. (*Steel castings.*) (BOSTON.)

Union Steel Casting Co., Pittsburgh, Pa., U.S.A. (*Steel castings.*) (PITTSBURGH.)

United Alloy Steel Corporation, Canton, O., U.S.A. (CLEVELAND, O.)

Upson Nut Co., Cleveland, O., U.S.A. (*Round and square steel bars.*) (CLEVELAND, O.)

Uraga Dock Co., Lim., Uraga, Japan. (*Steel castings.*) (YOKOHAMA.)

Usinele de Fer si Domeni i Le Din, Resita, Societatea Anonima, Timisoara-Bucuresti. (VIENNA.)

Usines & Aciéries Allard, Société Anonyme, Mont-sur-Marchienne, near Charleroi, Belgium. (*Steel castings.*) (ANTWERP.)

Usines Ch. Vermot, Valere Mabille & R. Pelgrims, Mariemont, Belgium. (*Small steel castings.*) (ANTWERP.)

Usines Emile Henricot, Court St. Etienne, Belgium. (*Steel castings.*) (ANTWERP)

Usines Gustave Boël (Aciéries de la Louvière), La Louvière, Belgium. (*Sections, rivet bars and steel castings.*) (ANTWERP.)

Usines Métallurgiques de la Basse Loire, Trignac, near St. Nazaire. (NANTES.)

Usines Métallurgiques du Hainaut, Couillet, and La Louvière, Belgium. (*Steel Foundry and Rolling Mills.*) (ANTWERP.)

Usines Skoda, Société Anonyme, Pilsen. (*Steel castings and forgings.*) (PRAGUE).

Van der Zypen und Wissener, Vereinigte Stahlwerke, Eisenhütten Act. Ges., Köln-Deutz, Germany. (*Bars and sections.*) (DÜSSELDORF.)

Vancouver Engineering Works, Lim., Vancouver, B.C. (*Steel castings.*) (VANCOUVER, B.C.)

Varde Staalvaerk, Varde, Denmark. (*Steel ingots and castings.*) (COPENHAGEN.)

Vulcan-Werke, Stettin. (*Steel castings.*) (STETTIN.)

Walkers, Lim., Maryborough, Queensland. (*Steel castings.*) (BRISBANE.)

Walsh Island Government Dockyard, Newcastle, N.S.W. (*Steel castings.*) (NEWCASTLE, N.S.W.)

Warman Steel Casting Co., Los Angeles, Cal., U.S.A. (*Steel castings.*) (SAN FRANCISCO.)

Washington Iron Works, Seattle, Wash., U.S.A. (*Steel castings.*) (SEATTLE.)

Wellman-Seaver-Morgan Co., Cleveland, O., U.S.A. (*Steel castings.*) (CLEVELAND, O.)

Wendel, les Petits Fils de F. de, Hayange, Lorraine. (PARIS.)

West Coast Iron Co., 16th and Rhode Island Streets, San Francisco, Cal., U.S.A. (*Steel ingots for forgings.*) (SAN FRANCISCO.)

Western Crucible Steel Co., Minneapolis, Minn., U.S.A. (*Steel castings.*) (DULUTH, MINN.)

Wharton, William, Jr., & Co., Inc., Easton, Pa., U.S.A. (*Steel castings.*) (PHILADELPHIA.)

Wheeling Mold & Foundry Co., Wheeling, W.Va., U.S.A. (*Steel castings.*) (PITTSBURGH.)

Witkowitzer Bergbau & Eisenhütten Gewerksschaft, Witkowitz, Mähren. (VIENNA.)

Worth Steel Co., Claymont, Del., and Coatesville, Pa., U.S.A. (PHILADELPHIA.)

Youngstown (The) Sheet & Tube Co., Youngstown, O., U.S.A. (PITTSBURGH.)

FIRMS IN COUNTRIES OTHER THAN THE UNITED KINGDOM.

ARRANGED ACCORDING TO SURVEYING DISTRICTS.

ANTWERP.

Aciéries de Mons, Nimy, Belgium. (*Small steel castings.*)

Compagnie Générale des Aciers, Société Anonyme, Thy-le-Chateau, Belgium. (*Steel castings.*)

Société Anonyme d'Athus-Grivegnée, Grivignée, near Liége, Belgium.

Société Anonyme de la Fabrique de Fer de Charleroi, Charleroi, Belgium.

Société Anonyme des Aciéries & Fonderies d'Art de Haine St. Pierre et Métallurgique Lilloise, Haine St. Pierre, Belgium. (*Steel castings.*)

Société Anonyme des Aciéries d'Angleur, Renory & Tilleur-lez-Liége Belgium.

Société Anonyme des Forges de Vireux-Molhain, Vireux-Molhain, Ardennes, France. (*Bars and sections only.*)

Société Anonyme des Forges et Laminoirs de Baume, Haine St. Pierre, Belgium. (*Rolling Mills for bars and sections.*)

Société Anonyme des Forges et Tôleries Liégeoises, Jupille-lez-Liége, Belgium.

Société Anonyme des Forges, Usines & Fonderies de Haine St. Pierre, Haine St. Pierre, Belgium. (*Steel castings.*)

Société Anonyme d'Ougrée-Marihaye, Ougrée, near Liége, Belgium.

Société Anonyme des Usines Gilson, La Croyère (Bois d'Haine), Belgium. (*Rolling Mills for sections.*)

Société Anonyme John Cockerill, Seraing, Belgium.

Société Anonyme Usines & Aciéries Leonard-Giot, Marchienne-au-Pont, Belgium. (*Steel castings.*)

ANTWERP—*continued.*

Usines & Aciéries Allard, Société Anonyme, Mont-sur-Marchienne, near Charleroi, Belgium. (*Steel castings.*)

Usines Ch. Vermot, Valere Mabille & R. Pelgrims, Mariemont, Belgium. (*Small steel castings.*)

Usines Emile Henricot, Court St. Etienne, Belgium. (*Steel castings.*)

Usines Gustave Boël (Aciéries de la Louvière), La Louvière, Belgium. (*Sections, rivet bars and steel castings.*)

Usines Métallurgiques du Hainaut, Couillet and La Louvière, Belgium. (*Steel Foundry and Rolling Mills.*)

BALTIMORE, MD.

Bethlehem Steel Co.
Lebanon, Pa., U.S.A. (*Rolling Mills for bars.*)
Sparrow's Point, Md., U.S.A.
Steelton, Pa., U.S.A.

Central Iron & Steel Co., Harrisburg, Pa., U.S.A. (*Rolling Mills.*)

BILBAO.

Compañia Anonima Basconia, Bilbao.

Sociedad Altos Hornos de Vizcaya, Bilbao.

Sociedad Anonima Aceros de Elorrieta, Bilbao. (*Steel castings.*)

Sociedad Anonima Fabrica de Mieres, Ablaña, Asturias, Spain.

Sociedad Anonima Fabrica de San Francisco del Desierto, Bilbao.

BILBAO—*continued.*

Sociedad Anonima Industrial Asturiana, Fabricas de Moreda y Gijon, Gijon. (*Rivet bars.*)
Sociedad Anomina Jose Maria Quijano, Forjas de Los Corrales de Buelna, Provincia de Santander, Spain. (*Steel bars.*)
Sociedad Anonima Talleres de Deusto, Deusto, Bilbao. (*Steel castings.*)
Sociedad Española de Construccion Naval, Reinosa, near Santander, Spain. (*Steel castings and forgings.*)
Sociedad Metalurgica Duro-Felguera, La Felguera, Asturias, Spain.

BIRMINGHAM, ALA.

American Machine & Manufacturing Co., Atlanta, Ga., U.S.A. (*Steel castings.*)
Anniston Steel Co., Anniston, Ala., U.S.A. (*Steel castings and rivet bars.*)
Gulf States Steel Co., Alabama City, Ala., U.S.A. (*Rivet and stay bars up to 2½ ins. diameter.*)
Tennessee Coal, Iron & Railroad Co., Birmingham, Ala., U.S.A. (*Steel Works* at Ensley, Ala., and *Rolling Mills* at Bessemer, Ala.)

BORDEAUX.

Compagnie des Forges et Aciéries de la Marine et d'Homécourt, Le Boucau (Forges de l'Adour), (Basses-Pyrénées), France. (*Bars and sections.*)

BOSTON.

Tremont Nail Co. (The), West Wareham, Mass., U.S.A. (*Steel ingots and forging billets.*)
Union Steel Casting Co., Boston, Mass., U.S.A. (*Steel castings.*)

BREMEN.

Atlas-Werke Akt. Ges., Bremen. (*Steel castings.*)

BRISBANE.

Walkers, Lim., Maryborough, Queensland. (*Steel castings.*)

BUFFALO, N.Y.

Atlas Steel Casting Co., Buffalo, N.Y. (*Steel castings.*)
Donner Steel Co., Inc. (The), Buffalo, N.Y., U.S.A.
Electric Steel & Metals Co., Lim., Welland, Ontario. (*Steel ingots and steel castings.*)
Gould-Coupler Co., Depew, N.Y., U.S.A. (*Steel ingots.*)
Lackawanna Steel Co., Buffalo, N.Y., U.S.A.
Otis Elevator Co., Buffalo, N.Y., U.S.A. (*Steel castings.*)
Sizer Forge Co., Buffalo, N.Y., U.S.A. (*Ingots and forgings.*)
Strong Steel Foundry Co., Buffalo, N.Y., U.S.A. (*Steel castings.*)

CAEN.

Société Normande de Métallurgie, Mondeville (Calvados), France.

CALCUTTA.

Tata Iron & Steel Co., Lim., Sakchi, India. (*Angles and Channels.*)

CHICAGO, ILL.

American Steel Foundries, Indiana Harbor, Ind., U.S.A. (*Steel castings.*)
Colorado (The), Fuel & Iron Co., Minnequa Works, Pueblo, Colo. (*Bars and small sections.*)
Falk Company, Milwaukee, Wis., U.S.A. (*Steel castings.*)
Hercules Steel Castings Co., Milwaukee, Wis., U.S.A. (*Steel castings.*)
Hubbard Steel Foundry Co., East Chicago, Ind., U.S.A. (*Steel castings.*)
Huntington Steel Co., Huntington, Ind., U.S.A. (*Steel castings.*)
Illinois Steel Co., Chicago, Ill., U.S.A.
Inland Steel Co. (*Steel Works* at Indiana Harbor, Ind., U.S.A., and *Rolling Mills* at Chicago Heights, Chicago, Ill., U.S.A.)
Interstate Iron and Steel Co., Chicago, Ill., U.S.A. (*Steel Works* at 118th Street, Chicago, and *Rolling Mills* at East Chicago, Ind.) (*Steel angles and bars.*)
Maynard Electric Steel Castings Co., Milwaukee, Wisconsin, U.S.A. (*Steel castings.*)
National Enameling & Stamping Co., Granite City, Ill., U.S.A.
National Malleable Castings Co., Melrose Park, Chicago, Ill., U.S.A. (*Steel ingots.*)
National Steel Foundries Co., Milwaukee, Wis., U.S.A. (*Steel castings.*)
Pelton Steel Co., Milwaukee, Wis., U.S.A. (*Steel castings.*)
Scullin Steel Co., St. Louis, Mo., U.S.A. (*Steel castings.*)
Steel & Tube Co. of America, Mark Plant, Indiana Harbor, Ind., U.S.A.

CHRISTIANIA.

Christiania Staalværk. (*Steel castings.*)
Stavanger Electro-Staalverk A/S., Stavanger, Norway. (*Steel castings.*)
Strömmens Verksted, near Christiania. (*Steel castings.*)

CLEVELAND, O.

American Rolling Mill Co., Middletown, O. (*Steel castings and forgings.*)
Andrews Steel Co., Newport, Kentucky, U.S.A. (*Ingots, blooms, billets and slabs.*)
Canton Steel Foundry Co., Canton, O., U.S.A. (*Steel castings and ingots.*)
Cleveland Steel Casting Co., Cleveland, O., U.S.A. (*Steel castings.*)
Corrigan, McKinney & Co., Cleveland, O., U.S.A. (*Steel ingots, blooms and billets.*)
Erie Forge Co., Erie, Pa., U.S.A. (*Steel ingots and forgings.*)
National Foundry Co., Erie, Pa., U.S.A. (*Steel castings.*)
National Tube Co., Lorain, O., U.S.A. (*Blooms, billets and plates.*)
Ohio Steel Foundry Co., Lima, O., U.S.A.
Otis Steel Co. (The), Cleveland, O., U.S.A.
United Alloy Steel Corporation, Canton, O., U.S.A.
Upson Nut Co., Cleveland, O., U.S.A. (*Round and square steel bars.*)
Wellman-Seaver-Morgan Co., Cleveland, O., U.S.A. (*Steel castings.*)

COLUMBUS, O.

Bonney-Floyd Co., Columbus, O., U.S.A. (*Steel castings.*)

COPENHAGEN.

Burmeister & Wain's Maskin-og Skibsbyggeri, Aktieselskabet, Copenhagen. (*Steel ingots, forgings and castings.*)

Varde Staalvaerk, Varde, Denmark. (*Steel ingots and castings.*)

DANZIG.

Schichau, F., Elbing, West Prussia, Germany. (*Steel castings.*)

DETROIT, MICH.

Buhl Malleable Co., Detroit, Mich., U.S.A. (*Steel castings.*)

Detroit Steel Casting Co., Detroit, Mich., U.S.A. (*Steel castings.*)

Monarch Steel Castings Co., Detroit, Mich., U.S.A. (*Steel castings.*)

Toledo Steel Casting Co., Toledo, O., U.S.A. (*Steel castings.*)

DULUTH, MINN.

Northwestern Steel and Iron Corporation, Minneapolis, Minn., U.S.A. (*Steel castings.*)

Twin City Forge and Foundry Co., Stillwater, Minnesota, U.S.A. (*Steel castings.*)

Western Crucible Steel Casting Co., Minneapolis, Minn., U.S.A. (*Steel castings.*)

DÜSSELDORF.

Annener Gussstahlwerk Akt. Ges., Annen, near Dortmund, Westphalia, Germany. (*Steel castings.*)

Bergische Stahl-Industrie G.m.b.H., Remscheid, Germany. (*Steel ingots and castings.*)

Bismarckhütte, Abteilung Bochum, Bochum, Westphalia, Germany. (*Steel Foundry and Rolling Mills.*)

Bochumer Verein für Bergbau & Gussstahlfabrikation, Bochum, Germany. (*Steel castings.*)

Charlottenhütte Akt. Ges., Niederschelden (Kreis Siegen), Germany. (*Steel plates and ingots.*)

Deutsch Luxemburgische Bergwerks-und Hütten-Act. Ges., Abteilung Dortmunder Union, Dortmund, Germany. (*Also Steel castings.*)

Düsseldorfer Eisen-und Draht-Industrie, Düsseldorf-Oberbilk, Germany. (*Bars and sections only.*)

Eichener Walzwerk und Verzinkerei Akt. Ges., Kreuztal, near Siegen, Germany. (*Rolling Mills.*)

Eisen-und Stahlwerk Hoesch, Dortmund, Germany. (*Rolling Mills.*)

Eisenwerk Kraft Act. Ges., Abteilung Niederrheinische Hütte, Duisburg-Hochfeld, Germany.

Geisweider Eisenwerke Act. Ges., Geisweid (Kreis Siegen), Germany. (*Rolling Mills.*)

Gelsenkirchener Guss stahl und Eisenwerke, Gelsenkirchen, Germany. (*Steel castings.*)

Gelsenkirchener Gussstahl und Eisenwerke, Abteilung Hagener Gussstahlwerke, Hagen, Westphalia, Germany. (*Steel castings and forgings.*)

DÜSSELDORF—*continued*

Gelsenkirchener Guss stahl und Eisenwerke, Abteilung Stahlwerk Krieger, Düsseldorf-Oberkassel, Germany. (*Steel castings.*)

Georgs-Marien Bergwerks-und Hütten-Verein Act. Ges., Osnabrück, Germany. (*Stee' castings.*)

Grafenberger Walzwerk G.m.b.H., Düsseldorf-Grafenberg, Germany. (*Rolling Mills.*)

Gruson (Otto) & Co., Eisen und Stahlwerk, Magdeburg-Buckau, Germany. (*Steel castings.*)

Gussstahl-Werk Witten, Witten a/d Ruhr, Germany.

Gutehoffnungshütte, Oberhausen, Rheinland, Germany. (*Also Steel castings.*)

Gutehoffnungshütte, Abteilung Haniel & Lueg, Düsseldorf-Grafenberg, Germany. (*Steel castings.*)

Hahnsche Werke Act. Ges., Grossenbaum, near Duisburg, Germany. (*Broad flats and ingots.*)

Hasper Eisen-und Stahlwerk, Haspe, Westphalia, Germany. (*Rolling Mills.*)

Henschel & Sohn, Abteilung Henrichshütte, near Hattingen a/d Ruhr, Germany.

Hüttengesellschaft der Rothen Erden, Aachen Rothe Erde, Germany. (*Rolling Mills.*)

Jaeger, G. & J., Kommandit Ges., Elberfeld, Germany. (*Steel castings*)

Krupp, Fried., Act. Ges., Stahlwerk Annen in Annen, Westphalia, Germany. (*Steel castings.*)

Krupp, Fried., Act. Ges., Essen, Germany. (*Also Steel castings.*)

Krupp, Fried., Act. Ges., Grusonwerk, Magdeburg, Germany. (*Steel castings.*)

Krupp, Fried. Act. Ges.-Friedrich Alfred Hütte, Rheinhausen-Friemersheim, Germany. (*Bars and Sections only.*)

Lauchhammer Akt. Ges., Abteilung Stahlwerk Torgau, Torgau, Germany. (*Steel castings.*)

Lauchhammer Akt. Ges., Abteilung Stahl & Walzwerk Riesa, Riesa, Germany. (*Rolling Mills.*)

Lauchhammer Akt. Ges., Lauchhammer, Germany. (*Steel Foundry* at Groditz.) (*Steel castings.*)

Lindener Eisen & Stahlwerke Akt. Ges., Hannover-Linden, Germany. (*Steel castings.*)

Mannesmannröhrenwerke, Abteilung Grillo Funke, Gelsenkirchen-Schalke, Westphalia, Germany.

Mannesmannröhrenwerke, Abteilung Schulz Knaudt, Hückingen, Germany. (*Steel Works and Rolling Mills.*)

Mannesmannröhrenwerke, Düsseldorf und Remscheid, Germany. (*Weldless rolled or drawn steel hollow pillars and davits.*)

Oberbilker Stahlwerk Akt. Ges., Düsseldorf-Oberbilk, Germany.

Panzer Akt. Ges. Gussstahlwerk, Wolgast, Germany. (*Small steel castings.*)

"Phœnix" Act. Ges. für Bergbau-und Hutten Betrieb, Ruhrort, Germany. (*Bars and sections only.*)

"Phœnix" Act. Ges. für Bergbau-und Hutten Betrieb, Abteilung Düsseldorfer Röhren und Eisen-Walzwerke, Düsseldorf-Oberbilk, Germany.

"Phœnix" Act. Ges. für Bergbau-und Hütten Betrieb, Abteilung Hoerder Verein, Hoerde, Westphalia, Germany. (*Also Steel castings.*)

Rheinische Stahlwerke, Duisburg-Meiderich, Germany. (*Bars and sections only.*)

DÜSSELDORF—*continued.*

Rheinische Stahlwerke, Abteilung Duisburger Eisen- und Stahlwerke, Duisburg, Germany.
Stahlwerk Gebr. Boehler, Act. Ges., Düsseldorf-Oberkassel. (*Ingots for steel forgings.*)
Stahlwerk "Mark" Act. Ges., Wengern-Ruhr, Germany. (*Steel castings.*)
Stahlwerk Oeking Act. Ges., Düsseldorf-Lierenfeld, Germany. (*Steel castings.*)
Storch & Schöneberg Akt. Ges. für Bergbau & Hüttenbetrieb, Weidenau-Sieg, Abteilung Bremerhütte, Geisweid, Germany. (*Steel plates and ingots.*)
Thyssen & Co., Mülheim a/d Ruhr, Germany.
Thyssen (August), Hütte Gewerkschaft, Hamborn-Bruckhausen am Rhein, Germany. (*Bars and sections only.*)
Van der Zypen und Wissener, Vereinigte Stahlwerke, Eisenhütten Act. Ges., Köln-Deutz, Germany. (*Bars and sections.*)

GENOA.

Acciaieria and Ferriera del Caleotto, Castello Sopra Lecco, Italy. (*Steel bars and small sections.*)
Acciaieria Danieli & Co., Brescia, Italy. (*Steel castings.*)
Acciaierie & Ferriere Lombarde; Head office, Milan. (Works at Milan, *weldless rolled or drawn steel tubes and hollow pillars.*) (Works at Sesto S. Giovanni, *bars, sections, steel castings, and steel plates.*)
Ferriera di Bolzaneto, near Genoa. (*For plates up to $\frac{3}{4}$ in. thickness.*)
Ferriere di Voltri, Voltri, Italy. (*Small sections, angles and bars.*)
Fonderia Milanese di Acciaio, Milan. (*Steel castings.*)
Ilva Alti Forni e Acciaierie d'Italia, Genoa.
Stabilimento di Pra, Pra.
Stabilimento di Bolzaneto, Bolzaneto.
Stabilimento di Sestri Ponente, Sestri Ponente.
Stabilimento di Savona, Savona.
S.A.I. Gio Ansaldo & Co., Fonderie & Acciaierie, Cornigliano Ligure, Italy. (*Steel castings.*)
S.A.I. Gio. Ansaldo & Co., Stabilimenti Elettrosiderurgici, Aosta, Italy.
Società Alti Forni, Fonderie, Acciaierie e Ferriere, Franchi-Gregorini, Forno d'Allione (Val Camonica), Italy. (*Steel ingots.*)
Società Alti Forni, Fonderie, Acciaierie e Ferriere, Franchi-Gregorini, Lovere, Italy. (*Bars and sections, castings and forgings.*)
Società Alti Forni e Acciaierie d'Italia, Porto Vecchio di Piombino, Italy. (*Sections and bars.*)
Società Anonima Ferriere di Voltri, Stabilimenti di Oneglia e Portomaurizio, Oneglia, Italy. (*Sections and bars.*)
Società Anonima Italiana Tubi Togni, Cogoleto, Ligure, Italy. (*Welded tubes, masts and pillars.*)
Società Italiana Ernesto Breda, Sesto S. Giovanni, Milan, Italy. (*Sections, forgings and castings.*)
Stabilimenti di Dalmine, Società Anonima, Dalmine (Bergamo). (*Weldless rolled or drawn steel tubes, hollow pillars and davits.*)

GOTHENBURG.

Aktiebolaget Bofors, Bofors, Sweden. (*Melting Furnaces and Foundry* at Bofors.)
Björneborgs Jernverks Aktiebolag, Björneborg, Sweden. (*Melting Furnaces and Forge.*)

GOTHENBURG—*continued.*

Motala Verkstads Nya Aktiebolag, Motala Verkstad, Sweden. (*Melting Furnaces, Rolling Mills and Forge.*)
Nydqvist & Holm Aktiebolag, Trollhättan, Sweden. (*Steel castings.*)
Strömsnäs Jernverks Aktiebolag, Degerfors, Sweden. (*Melting Furnaces and Rolling Mills.*)

HAKODATE.

The Japan Steel Works, Lim., Muroran, Japan. (*Steel ingots, forgings and castings.*)

HALIFAX, N.S.

Cumming (J.W.) Manufacturing Co., Lim., New Glasgow, Nova Scotia. (*Small steel castings.*)
Dominion Iron & Steel Co., Lim., Sydney, Nova Scotia. (*Steel ingots, billets, plates and sections.*)
Nova Scotia Steel & Coal Co., Lim. (*Steel Works* at North Sydney, C.B., and *Rolling Mills* at New Glasgow, N.S.) (*Bars and sections only.*)

HAMBURG.

Blohm & Voss, Hamburg, Germany. (*Steel castings.*)
Eisenhütte Holstein Act. Ges., Rendsburg, Germany.
Howaldtswerke, Kiel, Germany. (*Steel castings.*)
Michaelsen, Hermann, Eisen-und Stahl-Giesserei, Erdmannstrasse, 23, Altona-Ottensen, Germany. (*Steel castings.*)

HANKOW.

Han-Yeh-Ping Iron & Coal Co., Lim., Hanyang, China.

HAVRE.

Aciéries de Maromme (E. Breton), Maromme (Seine Inférieure), France. (*Steel castings.*)

KENJIHO.

Mitsu Bishi Seitetsu Kabushiki Kaisha, Kenjiho, Korea.

KOBE.

Kawasaki Dockyard Co., Lim. (Fukiai Works), Kobe, Japan.
Kawasaki Dockyard Co., Lim., Shiri-ike-mura, Hiogo, Japan. (*Steel castings, forgings, bars and sections.*)
Kobe Steel Works, Lim., Kobe, Japan. (*Steel castings, forgings, and plain and angle bars of small section.*)
Sumitomo Steel Works, Osaka, Japan. (*Steel castings and forgings.*)

MARSEILLES.

Compagnie des Forges de Chatillon, Commentry et Neuves-Maisons, France.
Compagnie des Forges et Aciéries de la Marine et d'Homécourt, St. Chamond (Loire), France.
Compagnie des Mines, Fonderies & Forges d'Alais, Tamaris Works, Alais, France. (*Bars and sections.*)
Fonderies, Forges et Aciéries de St. Etienne, St. Etienne, France.
Fonderies d'Acier du Midi, Marseilles. (*Steel castings.*)
Forges de la Loire et du Midi (Messrs. Marrel Frères), Rive de Gier, France.
Holtzer, Jacob, & Cie., Aciéries d'Unieux, Unieux (Loire), France. (*Steel castings.*)
Schneider & Co., Creusot.
Société Anonyme des Aciéries & Forges de Firminy, Firminy (Loire), France. (*Steel castings.*)
Société Anonyme des Hauts-Fourneaux, Fonderies & Forges de Franche-Comté, Besançon (Doubs), France.

MELBOURNE.

Ruwolt (Charles) Proprietary, Lim., Richmond, Melbourne. (*Steel castings.*)
Steel Company of Australia, Brunswick, Melbourne. (*Cast steel anchors.*)

MONTREAL.

Canadian Steel Foundries, Lim., Longue Pointe, Montreal. (*Steel castings.*)
Steel Company of Canada, Hamilton, Ontario. (*Works* at Montreal.) (*Bars and angles.*)
Thomas Davidson Manufacturing Co.(The), Lim.,Turcot, Montreal. (*Steel castings.*)

NAGASAKI.

Asano Kokura Steel Co., Lim., Konomimachi, Kokura, Japan. (*Ingots.*)
Asano Shipbuilding Co., Lim., Tsurumi, Japan. (*Rolling Mills for plates.*)
Imperial Steel Works, The, Yawata, Japan.
Mitsu Bishi Dockyard & Engine Works, Nagasaki, Japan. (*Steel castings.*)
Mitsubishi Zosen Kaisha, Nagasaki Steel Works, Urakami, Nagasaki, Japan. (*Steel ingots, blooms and forgings.*)

NANTES.

Société Anonyme des Aciéries Nantaises, Nantes. (*Steel castings.*)
Usines Métallurgiques de la Basse Loire, Trignac, near St. Nazaire.

NAPLES.

Ferriere ed Acciaierie del Vesuvio, Torre Annunziata, Naples. (*Rolling Mills for sections and bars.*)
Società degli Alti Forni, Fonderie ed Acciaierie di Terni. (*Works* at Terni.)
Società Ilva Bagnoli, Bagnoli, Naples. (*Sections and bars.*)

NEW YORK.

Adirondacks Steel Foundries Corporation, Watervliet, U.S.A.
Bayonne Steel Casting Co., Bayonne, N.J., U.S.A. (*Steel castings.*)
Malleable Iron Fittings Co., Branford, Conn., U.S.A. (*Steel castings.*)
New Jersey Steel Co., Rahway, N.J., U.S.A. (*Steel castings.*)
Riverside Steel Casting Co., Kearny, N.J., U.S.A. (*Steel castings.*)
Taylor-Wharton Iron & Steel Co., High Bridge, N.J., U.S.A. (*Steel castings.*)

NEWCASTLE, N S.W.

Broken Hill Proprietary Co., Lim., Iron and Steel Works, Newcastle, N.S.W. (*Steel plates, bars, sections and castings.*)
Walsh Island Government Dockyard, Newcastle, N.S.W. (*Steel castings.*)

PARIS.

Aciéries de Grenelle (E. Plichon), 56, Rue Lourmel, Paris. (*Steel castings.*)
Aciéries de Nanterre, Société Anonyme, Nanterre (Seine), France. (*Steel castings.*)

PARIS—*continued.*

Aciéries Réunies de Burbach-Eich-Dudelange (Arbed), Usines à Burbach, Saarbrucken-Burbach.
Dillinger Hüttenwerke Akt. Ges., Dillingen-Saar.
Hauts-Fourneaux Fonderies, Forges & Laminoirs de Meurthe & Moselle (Mr. Fould-Dupont), Usines de Pompey, France.
Mannesmannröhrenwerke, Abteilung Saarbrücker Gusstahlwerke, Saarbrücken-Burbach. (*Steel castings.*)
Mannesmannröhrenwerke, Bous.
Société Anonyme d'Escaut and Meuse, Anzin (Nord), France.
Société Anonyme des Fonderies et Aciéries de Hirson, Hirson, France. (*Steel castings.*)
Société Anonyme des Forges et Fonderies de Montataire, Montataire, France.
Société des Aciéries de Longwy, Mont St. Martin (Meurthe & Moselle), France.
Société Lorraine des Aciéries de Rombas, Rombas.
Wendel, les Petits Fils de F. de, Hayange, Lorraine.

PHILADELPHIA, PA.

Alan Wood, Iron & Steel Company, Conshohocken and Ivy Rock, Pa., U.S.A. (*Blooms, billets and thin plates.*)
American Bridge Co., Pencoyd Iron Works, Pencoyd, Pa., U.S.A. (*Sections, angles and bars.*)
American Locomotive Co., Chester, Pa., U.S.A. (*Steel castings.*)
American Manganese Steel Co., Newcastle, Del., U.S.A. (*Steel castings.*)
American Steel Foundries, Chester, Pa., U.S.A. (*Steel castings.*)
Atlantic Steel Castings Co., Chester, Pa., U.S.A. (*Steel castings.*)
Bethlehem Steel Co., Bethlehem, Pa., U.S.A.; Reading, Pa., U.S.A. (*Rolling Mills for bars.*)
Birdsboro' Steel Foundry & Machine Co., Birdsboro', Pa., U.S.A. (*Steel castings and ingots.*)
Chester Steel Castings Co., Chester, Pa., U.S.A. (*Steel castings.*)
Crucible Steel Castings Company, Lansdowne, Pa., U.S.A. (*Steel castings.*)
Drain Steel Co., Moore, Pa., U.S.A. (*Steel ingots.*)
Eagan-Rogers Steel & Iron Co., Inc., Crum Lynne, Pa., U.S.A. (*Small steel castings.*)
Eastern Steel Company, Pottsville, Pa., U.S.A. (*Sections and bars.*)
Federal Steel Foundry Co., Chester, Pa., U.S.A. (*Steel castings.*)
Glasgow Iron Co., Pottstown, Pa., U.S.A. (*Rolling Mills for plates.*)
Hoopes & Townsend Co., Philadelphia, Pa., U.S.A. (*Rolling Mills for bars* at Fort Washington, Pa.)
Luken's Iron & Steel Company, Coatesville, Pa., U.S.A.
Midvale Steel & Ordnance Company, Philadelphia, Pa., U.S.A.; Coatesville, Pa., U.S.A.
Nagle Steel Co., Pottstown, Pa., U.S.A.
Penn Seaboard Steel Corporation, Newcastle, Delaware, U.S.A.; Chester, Pa., U.S.A. (*Steel castings.*)
Pennsylvania Forge Co., Bridesburg, Philadelphia, Pa., U.S.A. (*Steel ingots and forgings.*)
Philadelphia Roll & Machine Co., Philadelphia, Pa., U.S.A. (*Steel castings.*)
Phœnix Iron Works, Phœnixville, Pa., U.S.A.

PHILADELPHIA, PA.—*continued.*

Reading Steel Casting Co., Reading, Pa., U.S.A. (*Small steel castings.*)
Tindell Morris Company, Eddystone, Pa., U.S.A. (*Steel ingots and forgings.*)
Treadwell Engineering Co., Easton, Pa., U.S.A. (*Steel castings.*)
Wharton, William, Jr., & Co., Inc., Easton, Pa., U.S.A. (*Steel castings.*)
Worth Steel Co., Claymont, Del., and Coatesville, Pa., U.S.A.

PITTSBURGH, PA.

Allegheny Steel Co., Brackenridge, Pa., U.S.A. (*Also steel castings.*)
American Steel & Wire Co. (Shoenberger Works), Fifteenth Street, Pittsburgh, Pa., U.S.A. (*Steel ingots, etc.*)
Brier Hill Steel Co. (The), Youngstown, O., U.S.A.
Cambria Steel Co., Johnstown, Pa., U.S.A.
Carbon Steel Co., Pittsburgh, Pa., U.S.A.
Carnegie Steel Co., Pittsburgh, Pa., U.S.A.
Crucible Steel Company of America, Park Works, Pittsburgh, Pa., U.S.A.
Forged Steel Wheel Company, Butler, Pa., U.S.A.
Jones & Laughlin Steel Company, Pittsburgh, Pa., U.S.A.
La Belle Iron Works, Steubenville, O., U.S.A.
National Malleable Castings Co., Sharon, Pa., U.S.A. (*Steel ingots.*)
Oliver Iron & Steel Co., Pittsburgh, Pa., U.S.A. (*Rolling Mills for bars.*)
Pittsburgh Crucible Steel Co., Midland, Pa., U.S.A.
Pittsburgh Steel Foundry, Glassport, Pa., U.S.A. (*Steel castings and ingots.*)
Republic Iron & Steel Co., Youngstown, O., U.S.A.
Sharon Steel Hoop Co., Youngstown, O. (*Steel melting plant* at Lowellville, O.; and *Rolling mills* at Youngstown, O.)
Sterling Steel Foundry Co., Braddock, Pa., U.S.A. (*Steel castings.*)
Union Steel Casting Co., Pittsburgh, Pa., U.S.A. (*Steel castings.*)
Wheeling Mold & Foundry Co., Wheeling, W. Va., U.S.A. (*Steel castings.*)
Youngstown (The) Sheet & Tube Co., Youngstown, O., U.S.A.

PORTLAND, OREGON.

Columbia Steel Co., Portland, Or., U.S.A. (*Steel castings.*)
Electric Steel Foundry, Portland, Or., U.S.A. (*Steel castings.*)

PRAGUE.

Oesterreichische Berg und Hüttenwerks Gesellschaft, Teschen, Silesia. (*Works* at Trzynietz and Karlshütte.)
Poldihütte Tiegelguss-stahlfabrik, Kladno, near Prague.
Prazska zelezarska spolecnost, Kladno, near Prague.
Usines Skoda, Société Anonyme, Pilsen. (*Steel castings and forgings.*)

ROTTERDAM.

Machine Fabriek Yzer-Staal & Metaal Gieterij (v/h Bakker & Co.) Ridderkerk. (*Steel castings.*)
Nederlandsche Staalfabrieken (v/h J. M. de Muinck Keizer), Utrecht, Holland. (*Steel castings.*)

SAN FRANCISCO, CAL.

Best Steel Casting Co., San Francisco, Cal., U.S.A. (*Steel castings.*)
Columbia Steel Company, Pittsburgh, Cal., U.S.A. (*Steel castings.*)
Judson Manufacturing Co., Emeryville, Alameda Co., Cal., U.S.A. (*Steel ingots.*)
Llewellyn Iron Works, Torrance, Cal., U.S.A. (*Round bars, small sections, also steel castings.*)
Pacific Coast Steel Co., South San Francisco, Cal., U.S.A. (*Steel ingots, small sections, and bars.*)
Southern California Iron & Steel Co., Los Angeles, Cal., U.S.A. (*Round bars.*)
Warman Steel Casting Co., Los Angeles, Cal., U.S.A. (*Steel castings.*)
West Coast Iron Co., 16th and Rhode Island Streets, San Francisco, Cal., U.S.A. (*Steel ingots for forgings.*)

SEATTLE, WASH.

Olympic Steel Works, Seattle, Wash., U.S.A. (*Steel castings.*)
Pacific Coast Steel Co., Seattle, Wash., U.S.A. (*Sections and bars.*)
Puget Sound Steel Works, Tacoma, Wash., U.S.A. (*Steel castings.*)
Washington Iron Works, Seattle, Wash., U.S.A. (*Steel castings.*)

STETTIN.

Vulcan Werke, Stettin. (*Steel castings.*)

STOCKHOLM.

Avesta Jernverks Aktiebolag, Avesta, Sweden. (*Steel plates, sections, and high pressure air receivers.*)
Bultfabriks Aktiebolaget, Hallstahammar, Sweden. (*Steel castings.*)
Fagersta Bruks Aktiebolag, Fagersta, Sweden. (*Steel blooms and billets.*)
Forsbacka Jernverks Aktiebolag, Forsbacka, Sweden. (*Steel blooms, billets, tubes, and forged and rolled bars.*)
Kohlswa Jernverks Aktiebolag. (*Melting Furnaces, Foundry and Forge* at Kohlswa, Sweden.)
Latorps Bruk, Finspong, Sweden. (*Managers*, Kohlswa Jernverks Aktiebolag.) (*Melting Furnaces and Forge.*)
Sandvikens Jernverks Aktiebolag, Sandviken, Sweden. (*Steel ingots, forgings, and steel tubes.*)
Smedjebackens Valsverks Aktiebolaget, Smedjebacken, Sweden. (*Steel sections and castings.*)
Stora Kopparbergs Bergslags Aktiebolag, Falun, Sweden. (*Steel Works* at Domnarfvet.) (*Sections of all sizes and plates up to $\frac{3}{4}$ in. thick.*)
Surahammars Bruks Aktiebolag, Surahammar, Sweden. (*Forge and Rolling Mills.*)

SYDNEY, N.S.W.

Australian Electric Steel Co., Alexandria, Sydney, N.S.W. (*Steel castings.*)
Commonwealth Government Naval Dockyard, Cockatoo, Sydney, N.S.W. (*Steel castings.*)
Lithgow Iron & Steel Works, Lithgow, N.S.W. (*Bars and sections.*)

TORONTO, ONTARIO.

Algoma Steel Corporation, Lim., Sault St. Marie, Ontario, Canada. (*Steel billets, bars and angles.*)
Dominion Steel Foundry Co., Lim., Hamilton, Ontario. (*Steel castings.*)
Steel Company of Canada, Hamilton, Ontario. (*Works* at Hamilton and Belleville.) (*Bars and angles.*)

TRIESTE.

Krainische Industrie-Gesellschaft, Assling-Hütte, Carniole, Jugo-Slavia.
Krainische Industrie-Gesellschaft, Servola, near Trieste.

VANCOUVER, B.C.

Vancouver Engineering Works, Lim., Vancouver, B.C. (*Steel castings.*)

VIENNA.

Bismarckhütte (Bismarckhütte & Falvahütte), Bismarckhütte, Oberschlesien, Germany. (*Also steel castings, and weldless rolled or drawn steel hollow pillars and davits.*)
Böhler, Gebr., & Co., Akt. Ges., Vienna. (*Works* at Kapfenberg, Styria.) (*Steel castings.*)
Borsig, A. (Berg und Hütten-Verwaltung), Borsigwerk, Oberschlesien, Germany. (*Also Steel castings.*)
Ganz & Co., Danubius Ratibor, Silesia, Germany. (*Steel castings.*)
Königs und Laurahütte, Vereinigte Akt. Ges., für Bergbau und Hüttenbetrieb, Konigshütte & Laurahütte, Oberschlesien, Germany.
Oberschlesische Eisen-Industrie Act. Ges., Baildonhütte, near Kattowitz, Germany.

VIENNA—*continued.*

Oberschlesische Eisenbahn-Bedarfs Akt. Ges., Gleiwitz, Oberschlesien, Germany. (*Works* at Friedenshütte in Friedenshütte.)
Oesterreichisch-Alpine Montangesellschaft, Friedrichstrasse, 4, Vienna, I. (*Works* at Donawitz, near Leoben, Neuberg, and Zeltweg, Styria, Deutsch-Oesterreich.)
Phönix Stahlwerke Joh. E. Bleckmann, Mürzzuschlag, Deutsch-Oesterreich. (*Steel bars.*)
Rimamurany-Salgo-Tarjaner Eisenwerks Act. Ges., Budapest. (*Steel works* in Ozd, Hungary.)
Société Anonyme des Forges et Aciéries de Huta, Bankowa, Dombrowa, Poland. (*Steel plates, sections and castings.*)
Sosnowicer Röhrenwalzwerke und Eisenwerke, Warsaw and Zawiercie, Poland. (*Works* at Sosnowice, Poland.) (*Plates, bars and sections; seamless and welded tubes.*)
Statni Zelezarny Ceskoslovenske republiky v. Podbrezove.
Steirische Gusstahlwerke Act. Ges., Iudenburg, Styria, Deutsch-Oesterreich. (*Steel castings.*)
Ternitzer Stahl und Eisenwerke von Schoeller & Co., Ternitz, Austria. (*Steel bars and castings.*)
Usinele de Fer si Domeni i Le Din, Resita, Societatea Anonimà, Timisoara-Bucuresti.
Witkowitzer Bergbau & Eisenhütten Gewerksschaft, Witkowitz, Mähren.

WINTERTHUR.

Société Anonyme des Aciéries ci-devant Georges Fischer, Schaffhouse, Switzerland. (*Steel castings.*)
Sulzer Frères, Société Anonyme, Winterthur, Switzerland. (*Steel castings.*)

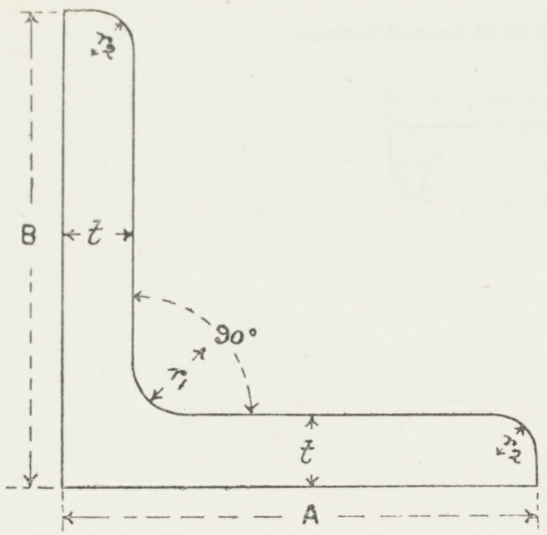
YOKOHAMA.

Nippon Kokan Kabushiki Kaisha, Kawasaki, Japan. (*Steel tubes, bars and sections.*)
Oshima Steel Works, Oshima, Tokio, Japan. (*Steel castings and forgings.*)
Uraga Dock Co., Lim., Uraga, Japan. (*Steel castings.*)

(*Revised, July,* 1921.)

BRITISH STANDARD SECTIONS.

EQUAL ANGLES.

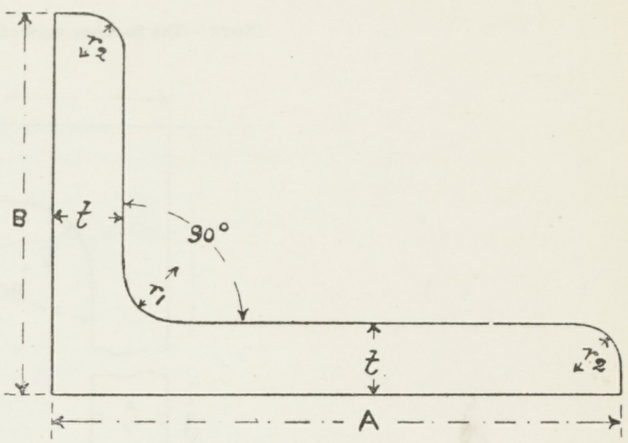


Size. A × B	Thickness at Correct Standard Profile. Minimum. t	Mean. t	Maximum. t	Minimum thickness rolled.	Maximum thickness rolled.	Radii. Root. r_1	Toe. r_2
Inches.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.
1 × 1	·125	—	·250	·125	·300	·175	·125
1¼ × 1¼	·125	—	·250	·125	·300	·200	·150
1½ × 1½	·125	—	·250	·125	·350	·200	·150
1¾ × 1¾	·175	—	·300	·175	·375	·225	·150
2 × 2	·175	—	·300	·175	·400	·250	·175
2¼ × 2¼	·175	—	·300	·175	·450	·250	·175
2½ × 2½	·250	·375	·500	·200	·500	·275	·200
2¾ × 2¾	·250	·375	·500	·225	·525	·275	·200
3 × 3	·250	·375	·500	·250	·525	·300	·200
3½ × 3½	·300	·425	·500	·275	·575	·325	·225
4 × 4	·300	·425	·500	·300	·625	·350	·250
4½ × 4½	·375	—	·500	·325	·650	·400	·275
5 × 5	·375	—	·500	·350	·700	·425	·300
6 × 6	·450	—	·625	·425	·775	·475	·325
7 × 7	·500	—	·675	·475	·850	·550	·375
8 × 8	·550	—	·750	·550	·950	·600	·425

LONDON.—*July, 1909.*

UNEQUAL ANGLES.

(NOTE:—The Section marked thus * is additional to the British Standard Sections.)



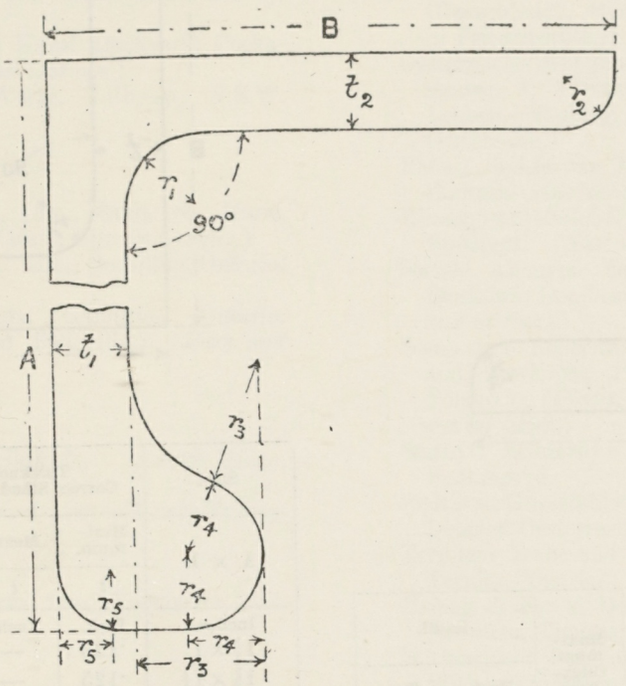
Size. A × B	Thickness at Correct Standard Profile. Minimum. t	Mean. t	Maximum. t	Minimum thickness rolled.	Maximum thickness rolled.	Radii. Root. r_1	Toe. r_2
Inches.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.
1¼ × 1	·125	—	·250	·125	·300	·175	·125
1½ × 1¼	·125	—	·250	·125	·325	·200	·150
1¾ × 1½	·175	—	·300	·150	·350	·225	·150
2 × 1½	·175	—	·300	·175	·375	·225	·150
2½ × 1½	·150	—	·300	·150	·400	·250	·175
2½ × 2	·175	—	·300	·175	·450	·250	·175
3 × 1½	·175	—	·300	·150	·450	·250	·175
3 × 2	·250	·375	·500	·200	·500	·275	·200
3 × 2½	·250	·375	·500	·225	·525	·275	·200
3½ × 2	·225	—	·500	·225	·525	·275	·200
3½ × 2½	·250	·375	·500	·250	·525	·300	·200
3½ × 3	·250	·375	·500	·250	·550	·325	·225
4 × 2½	·250	·375	·500	·250	·550	·325	·225
4 × 3	·300	·425	·500	·275	·575	·325	·225
4 × 3½	·300	·425	·500	·275	·600	·350	·250
4½ × 3	·300	·425	·500	·275	·600	·350	·250
4½ × 3½	·300	·425	·500	·300	·625	·350	·250
5 × 3	·300	·425	·500	·300	·625	·350	·250
5 × 3½	·375	—	·500	·325	·625	·375	·250
5 × 4	·375	—	·500	·325	·650	·400	·275
5½ × 3	·375	—	·500	·325	·625	·375	·250
5½ × 3½	·375	—	·500	·325	·650	·400	·275
6 × 3	·375	—	·500	·325	·650	·400	·275
6 × 3½	·375	—	·500	·350	·675	·400	·275
6 × 4	·375	—	·500	·350	·700	·425	·300
*6½ × 3	·375	—	·500	·350	·700	·425	·300
6½ × 3½	·375	—	·500	·350	·700	·425	·300
6½ × 4½	—	·550	—	·400	·750	·450	·325
7 × 3½	—	·525	—	·375	·725	·425	·300
7 × 4	—	·550	—	·400	·750	·450	·325
8 × 3½	—	·575	—	·400	·750	·475	·325
8 × 4	—	·625	—	·425	·775	·475	·325
9 × 4	—	·650	—	·450	·825	·500	·350
10 × 4	—	·675	—	·475	·850	·550	·375

LONDON.—*6th May, 1915.*

BRITISH STANDARD SECTIONS.

BULB ANGLES.

(NOTE:—The Sections marked thus * are additional to the British Standard Sections.)



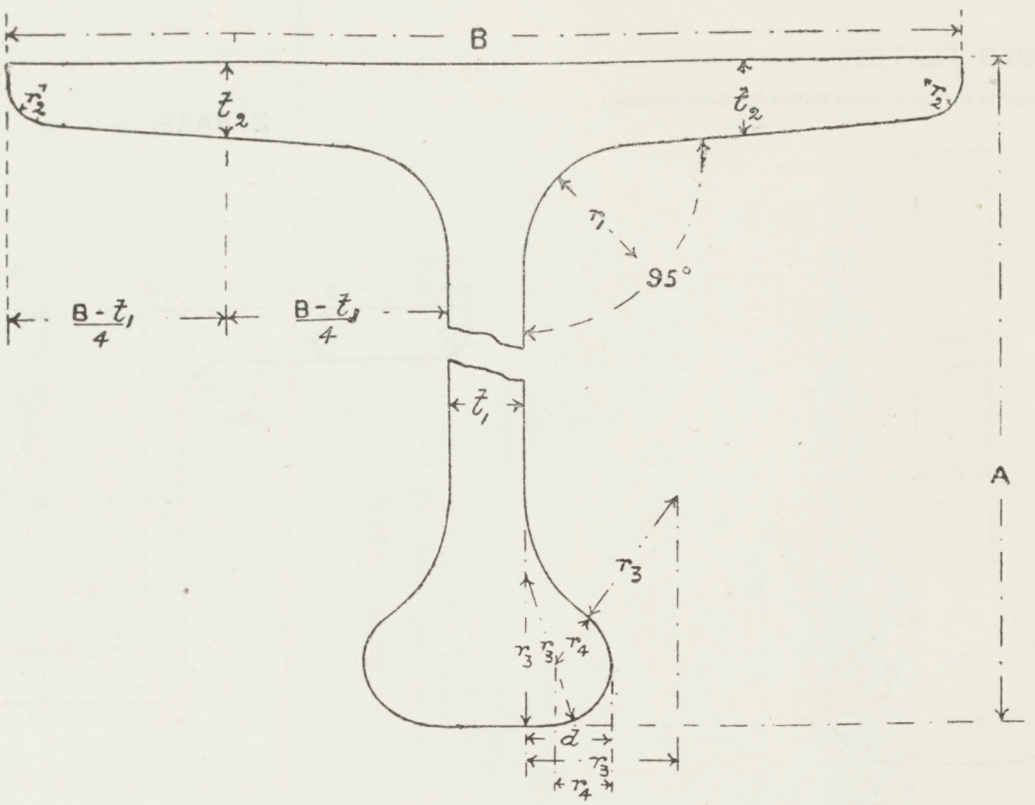
Size.	Thickness at Correct Standard Profile.		Web thickness.		Radii.				
	Web	Flange.	Maximum rolled.	Minimum rolled.					
A × B	t_1	t_2			r_1	r_2	r_3	r_4	r_5
Inches.	Inch.		Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.
4 × 2½	·300		·500	·240	·300	·200	·525	·300	·250
5 × 2½	·325		·525	·280	·350	·250	·600	·350	·300
5 × 3	·325		·525	·280	·350	·250	·600	·350	·300
5½ × 3	·350		·550	·300	·375	·250	·650	·375	·325
6 × 3	·375		·575	·320	·400	·275	·675	·400	·325
6 × 3½	·375		·575	·320	·400	·275	·675	·400	·325
6½ × 3	·375		·575	·340	·425	·275	·700	·425	·350
6½ × 3½	·400		·600	·340	·425	·275	·700	·425	·350
7 × 3	·400		·600	·360	·450	·300	·750	·450	·375
7 × 3½	·425		·625	·360	·450	·300	·750	·450	·375
7½ × 3	·425		·625	·380	·475	·325	·800	·475	·400
7½ × 3½	·425		·625	·380	·475	·325	·800	·475	·400
8 × 3	·425		·625	·400	·500	·325	·825	·500	·400
8 × 3½	·450		·650	·400	·500	·325	·825	·500	·400
8½ × 3	·450		·650	·420	·525	·350	·850	·525	·425
8½ × 3½	·475		·675	·420	·525	·350	·850	·525	·425
9 × 3	·475		·675	·440	·550	·350	·900	·550	·450
9 × 3½	·475		·675	·440	·550	·350	·900	·550	·450
9½ × 3½	·500		·700	·450	·550	·375	·950	·550	·475
10 × 3½	·525		·725	·460	·575	·400	·975	·575	·500
*10½ × 3½	·525		·725	·470	·575	·400	·975	·575	·500
11 × 3½	·550		·750	·480	·625	·425	1·050	·625	·525
*11½ × 3½	·575		·775	·490	·650	·450	1·100	·650	·550
12 × 3½	·575		·775	·500	·675	·450	1·125	·675	·550
12 × 4	·600		·800	·500	·675	·450	1·125	·675	·550

Where the thickness of Bulb Angle is greater than the Standard thickness, the flange and web will not be of the same thickness; generally for each ·05 inch increase in the thickness of the web the thickness of the flange will be increased ·025 inch.

LONDON.—*6th May, 1915.*

BRITISH STANDARD SECTIONS.

BULB TEES.



Size.	Thickness at correct Standard profile.		Web thickness.			Radii.			
	Web.	Flange.	Maximum rolled.	Minimum rolled.					
A × B	t_1	t_2			d	r_1	r_2	r_3	r_4
Inches.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.
7 × 5	·425	·425	·500	·350	·450	·600	·200	·800	·300
8 × 5½	·450	·450	·525	·375	·500	·675	·225	·900	·325
9 × 5½	·475	·500	·550	·400	·575	·750	·250	1·000	·375
10 × 6	·500	·550	·575	·425	·625	·825	·275	1·100	·400
11 × 6½	·550	·600	·625	·475	·675	·900	·300	1·200	·450
12 × 6½	·575	·650	·650	·500	·725	·975	·325	1·300	·475

The standard thickness of flange of Bulb Tees is to be measured at a distance half way between the extreme edges of the flanges and the nearer side of the web.

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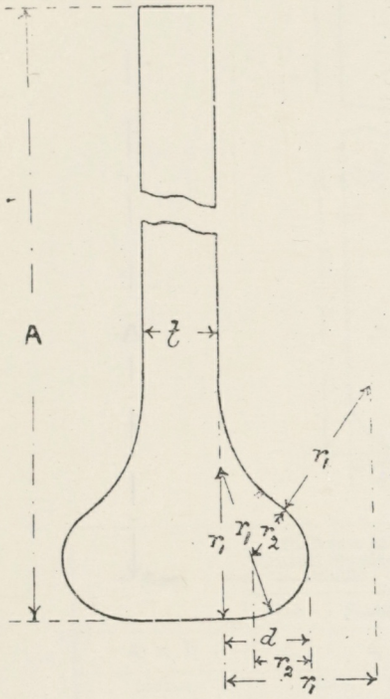
BRITISH STANDARD SECTIONS.

BULB PLATES.

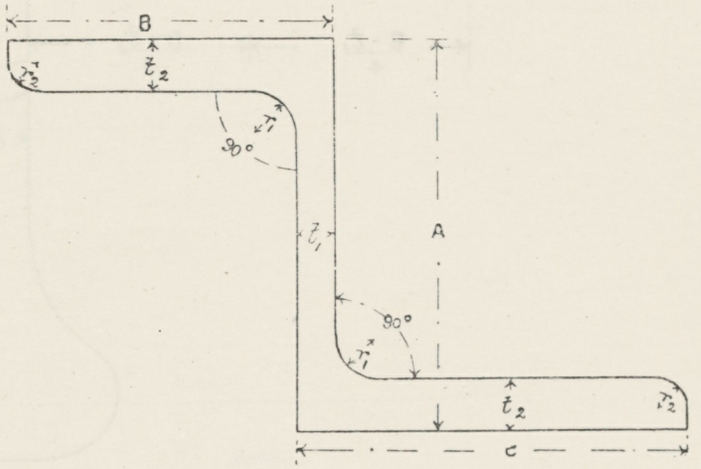
(NOTE:—The Section marked thus * is additional to the British Standard Sections.)



Size.	Thickness at Correct Standard Profile.	Thickness.			Radii.	
A		Maximum rolled.	Minimum rolled.	d	r_1	r_2
Inches.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.
*5	·250	·350	·200	·350	·550	·200
6	·300	·400	·250	·400	·700	·250
7	·350	·450	·275	·450	·800	·300
8	·400	·525	·325	·500	·900	·325
9	·450	·575	·350	·575	1·000	·375
10	·500	·625	·375	·625	1·100	·400
11	·550	·700	·425	·675	1·200	·450
12	·600	·750	·450	·725	1·300	·475

LONDON.—*July, 1910.*

Z BARS.



Size.	Thickness at Correct Standard Profile.		Web thickness.		Radii.	
Web and Flanges.	Web.	Flanges.	Maximum rolled.	Minimum rolled.	Root.	Toe.
A × B × C	t_1	t_2			r_1	r_2
Inches.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.
3 × 2½ × 3	·300	·400	·500	·300	·325	·225
4 × 1½ × 2	·150	·250	·475	·150	·300	·200
4 × 2 × 2	·175	·275	·475	·175	·325	·225
4 × 2½ × 3	·325	·425	·525	·325	·350	·225
5 × 3 × 3	·350	·450	·550	·350	·375	·250
6 × 3½ × 3½	·375	·475	·575	·375	·425	·300
7 × 3½ × 3½	·400	·500	·600	·400	·450	·300
8 × 3½ × 3½	·425	·525	·625	·425	·450	·325
9 × 3½ × 3½	·450	·550	·650	·450	·475	·350
10 × 3½ × 3½	·475	·575	·675	·475	·500	·350

When the thickness of Zed bar is greater than the Standard thickness, the increase in thickness of flanges and web will not be the same; generally, for each ·05 inch increase in the thickness of the web, the flange will be increased ·025 inch.

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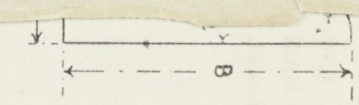
9	$1\frac{9}{16}$	$1\frac{9}{16}$	5 — 4	9	$16\frac{1}{4}$	$9\frac{1}{2} \times 5\frac{1}{4}$	$7\frac{1}{2} \times 4\frac{1}{4}$	$6 \times 3\frac{3}{4}$
$9\frac{1}{2}$	$1\frac{3}{8}$	$1\frac{11}{16}$	5 — 8	$9\frac{1}{2}$	17	$10 \times 5\frac{3}{4}$	$8 \times 4\frac{1}{2}$	$6\frac{1}{2} \times 3\frac{3}{4}$
10	$1\frac{7}{16}$	$1\frac{3}{4}$	6 — 0	10	18	$10\frac{1}{2} \times 6$	$8\frac{1}{2} \times 4\frac{1}{2}$	7×4
$10\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{7}{8}$	6 — 4	$10\frac{1}{2}$	19	$11 \times 6\frac{1}{4}$	$9 \times 4\frac{3}{4}$	$7\frac{1}{2} \times 4$
11	$1\frac{9}{16}$	$1\frac{15}{16}$	6 — 8	11	$19\frac{3}{4}$	$11\frac{1}{2} \times 6\frac{3}{4}$	$9\frac{1}{2} \times 5$	8×4
$11\frac{1}{2}$	$1\frac{5}{8}$	$1\frac{15}{16}$	7 — 0	$11\frac{1}{2}$	$20\frac{3}{4}$	12×7	$10 \times 5\frac{1}{4}$	$8\frac{1}{2} \times 4\frac{1}{2}$
12	$1\frac{5}{8}$	2	7 — 4	12	$21\frac{1}{2}$	$12\frac{1}{2} \times 7\frac{1}{2}$	$10\frac{1}{2} \times 5\frac{1}{2}$	$8\frac{1}{2} \times 5$
$12\frac{1}{2}$			7 — 8	$12\frac{1}{2}$	$22\frac{1}{2}$	$13 \times 7\frac{1}{2}$	$11 \times 5\frac{1}{2}$	9×5
13			8 — 0	13	$23\frac{1}{2}$	$13\frac{1}{2} \times 7\frac{1}{2}$	$11\frac{1}{4} \times 5\frac{3}{4}$	$9\frac{1}{2} \times 5$
$13\frac{1}{2}$			8 — 0	$13\frac{1}{2}$	$24\frac{1}{2}$	14×8	$11\frac{1}{2} \times 6$	10×5
14			8 — 0	14	$25\frac{1}{4}$	$14\frac{1}{2} \times 8$	12×6	$10 \times 5\frac{1}{4}$
$14\frac{1}{2}$			8 — 0	$14\frac{1}{2}$	$26\frac{1}{4}$	$15 \times 8\frac{1}{2}$	$12\frac{1}{4} \times 6\frac{1}{2}$	$10\frac{1}{2} \times 5\frac{1}{4}$
15			8 — 0	15	27	$15\frac{1}{2} \times 8\frac{1}{2}$	$12\frac{3}{4} \times 6\frac{1}{2}$	$11 \times 5\frac{1}{2}$

NOTE—TABLE 49

Where special steel short link chains (*see* P 1301 Grade III) are used, the diameter given in column 2 above may be reduced as follows:—

Table size inches	*Reduction inches*
$\frac{15}{16}$ and below	$\frac{1}{16}$
1 — $1\frac{3}{16}$	$\frac{1}{8}$
$1\frac{1}{4}$ — $1\frac{5}{8}$	$\frac{3}{16}$



Sections.)

Toe.	Inch.	r_2	adii.
·625	·325		
	·325		
	·325		
	·350		
	·350		
	·350		
	·375		
	·375		
	·375		
	·375		
	·400		
	·400		
	·400		
	·400		
	·400		
	·375		
	·425		
	·425		
	·425		
	·425		
	·425		
	·425		

The Standard thickness of flanges of Channel bar is to be measured at distances half-way between the extreme edges of the flanges and the nearer side of the web.

The web of Channel bars can vary in thickness between the limits shown in the Table, but the thickness of flange remains constant.

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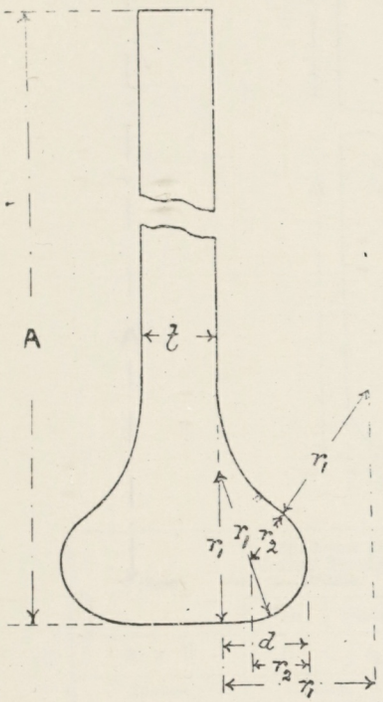
BRITISH STANDARD SECTIONS.

BULB PLATES.

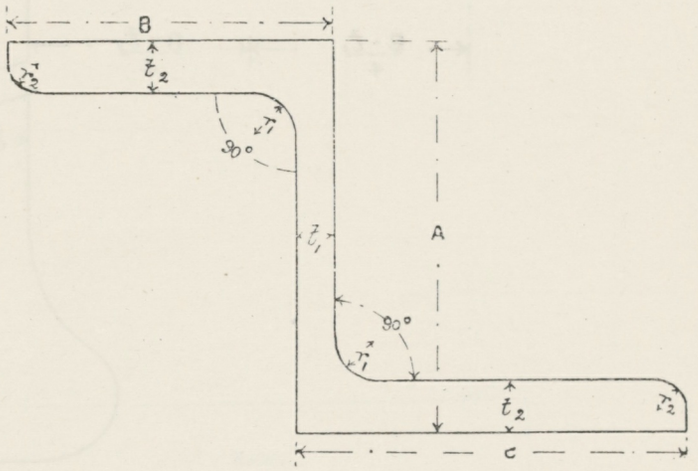
(NOTE:—The Section marked thus * is additional to the British Standard Sections.)



Size.	Thickness at Correct Standard Profile.	Thickness.			Radii.	
		Maximum rolled.	Minimum rolled.	d	r_1	r_2
A						
Inches.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.
*5	·250	·350	·200	·350	·550	·200
6	·300	·400	·250	·400	·700	·250
7	·350	·450	·275	·450	·800	·300
8	·400	·525	·325	·500	·900	·325
9	·450	·575	·350	·575	1·000	·375
10	·500	·625	·375	·625	1·100	·400
11	·550	·700	·425	·675	1·200	·450
12	·600	·750	·450	·725	1·300	·475

LONDON.—*July, 1910.*

Z BARS.



Size.	Thickness at Correct Standard Profile.		Web thickness.		Radii.	
Web and Flanges.	Web.	Flanges.	Maximum rolled.	Minimum rolled.	Root.	Toe.
A × B × C	t_1	t_2			r_1	r_2
Inches.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.
3 × 2½ × 3	·300	·400	·500	·300	·325	·225
4 × 1½ × 2	·150	·250	·475	·150	·300	·200
4 × 2 × 2	·175	·275	·475	·175	·325	·225
4 × 2½ × 3	·325	·425	·525	·325	·350	·225
5 × 3 × 3	·350	·450	·550	·350	·375	·250
6 × 3½ × 3½	·375	·475	·575	·375	·425	·300
7 × 3½ × 3½	·400	·500	·600	·400	·450	·300
8 × 3½ × 3½	·425	·525	·625	·425	·450	·325
9 × 3½ × 3½	·450	·550	·650	·450	·475	·350
10 × 3½ × 3½	·475	·575	·675	·475	·500	·350

When the thickness of Zed bar is greater than the Standard thickness, the increase in thickness of flanges and web will not be the same; generally, for each ·05 inch increase in the thickness of the web, the flange will be increased ·025 inch.

LONDON.—*6th May, 1915.*

COUPLINGS OF RUDDER HEADS — TABLE 48

DIAMETER OF RUDDER HEAD TABLE 44	HORIZONTAL COUPLING 6 BOLTS		VERTICAL COUPLING 8 BOLTS		SCARPHED COUPLING					
						WIDTH OF SCARPHS		BOLTS		
								NUMBER		
	MEAN DISTANCE OF CENTRES OF BOLTS FROM CENTRE OF COUPLING	DIAMETER OF BOLTS AND THICKNESS OF FLANGES	WIDTH OF COUPLING	DIAMETER OF BOLTS AND THICKNESS OF FLANGES	LENGTH OF SCARPH	AT TOP	AT BOTTOM	TOTAL	IN TOP ROW	DIAMETER
Inches	Inches	Inches	Inches	Inches	Inches	Inches	Inches			Inches
$3\frac{1}{2}$	4	$1\frac{1}{8}$								
$3\frac{3}{4}$	4	$1\frac{1}{8}$								
4	$4\frac{1}{4}$	$1\frac{1}{4}$								
$4\frac{1}{4}$	$4\frac{1}{4}$	$1\frac{1}{4}$								
$4\frac{1}{2}$	$4\frac{1}{2}$	$1\frac{3}{8}$	12	$1\frac{3}{8}$	$13\frac{1}{2}$	9	15	6	2	$1\frac{1}{2}$
$4\frac{3}{4}$	$4\frac{1}{2}$	$1\frac{3}{8}$	12	$1\frac{3}{8}$	$13\frac{1}{2}$	9	15	6	2	$1\frac{1}{2}$
5	$4\frac{1}{2}$	$1\frac{3}{8}$	12	$1\frac{3}{8}$	$13\frac{1}{2}$	9	15	6	2	$1\frac{1}{2}$
$5\frac{1}{4}$	$4\frac{3}{4}$	$1\frac{1}{2}$	12	$1\frac{1}{2}$	$13\frac{1}{2}$	9	15	6	2	$1\frac{1}{2}$
$5\frac{1}{2}$	5	$1\frac{1}{2}$	$12\frac{1}{2}$	$1\frac{1}{2}$	14	$9\frac{1}{2}$	$15\frac{1}{2}$	6	2	$1\frac{5}{8}$
$5\frac{3}{4}$	$5\frac{1}{4}$	$1\frac{1}{2}$	13	$1\frac{1}{2}$	$14\frac{1}{2}$	10	16	6	2	$1\frac{3}{4}$
6	$5\frac{1}{2}$	$1\frac{5}{8}$	$13\frac{1}{2}$	$1\frac{5}{8}$	15	$10\frac{1}{2}$	$16\frac{1}{2}$	6	2	$1\frac{7}{8}$
$6\frac{1}{4}$	$5\frac{3}{4}$	$1\frac{3}{4}$	14	$1\frac{3}{4}$	$15\frac{3}{4}$	11	$17\frac{1}{4}$	6	2	2
$6\frac{1}{2}$	6	$1\frac{7}{8}$	$14\frac{1}{2}$	$1\frac{7}{8}$	$16\frac{1}{4}$	$11\frac{1}{2}$	18	6	2	$2\frac{1}{8}$
$6\frac{3}{4}$	$6\frac{1}{4}$	$1\frac{7}{8}$	15	$1\frac{7}{8}$	17	12	$18\frac{3}{4}$	6	2	$2\frac{1}{8}$
7	$6\frac{1}{2}$	2	$15\frac{3}{4}$	2	$17\frac{1}{2}$	$12\frac{1}{4}$	$19\frac{1}{2}$	6	2	$2\frac{1}{4}$
$7\frac{1}{4}$	$6\frac{3}{4}$	$2\frac{1}{8}$	$16\frac{1}{4}$	$2\frac{1}{8}$	18	$12\frac{3}{4}$	20	6	2	$2\frac{1}{4}$
$7\frac{1}{2}$	7	$2\frac{1}{8}$	$16\frac{3}{4}$	$2\frac{1}{8}$	$18\frac{3}{4}$	$13\frac{1}{4}$	21	7	2	$2\frac{1}{8}$
$7\frac{3}{4}$	$7\frac{1}{4}$	$2\frac{1}{4}$	$17\frac{1}{4}$	$2\frac{1}{4}$	$19\frac{1}{2}$	$13\frac{1}{2}$	$21\frac{1}{2}$	7	2	$2\frac{1}{8}$
8	$7\frac{1}{2}$	$2\frac{3}{8}$	18	$2\frac{3}{8}$	20	14	22	7	2	$2\frac{1}{4}$
$8\frac{1}{2}$	$7\frac{3}{4}$	$2\frac{1}{2}$	19	$2\frac{1}{2}$	$21\frac{1}{4}$	15	24	7	2	$2\frac{1}{2}$
9	$8\frac{1}{4}$	$2\frac{3}{4}$	20	$2\frac{3}{4}$	$22\frac{1}{2}$	$15\frac{3}{4}$	25	7	2	$2\frac{5}{8}$
$9\frac{1}{2}$	$8\frac{1}{2}$	$2\frac{7}{8}$	$21\frac{1}{4}$	$2\frac{7}{8}$	$23\frac{3}{4}$	$16\frac{3}{4}$	26	7	2	$2\frac{3}{4}$
10	9	3	$22\frac{1}{2}$	3	25	$17\frac{1}{2}$	$27\frac{1}{2}$	7	2	$2\frac{7}{8}$
$10\frac{1}{2}$	$9\frac{1}{2}$	$3\frac{1}{8}$	$23\frac{1}{2}$	$3\frac{1}{8}$	$26\frac{1}{4}$	$18\frac{1}{2}$	29	8	2	$2\frac{7}{8}$
11	10	$3\frac{1}{4}$	$24\frac{3}{4}$	$3\frac{1}{4}$	$27\frac{1}{2}$	$19\frac{1}{4}$	30	8	2	3
$11\frac{1}{2}$	$10\frac{1}{2}$	$3\frac{3}{8}$	26	$3\frac{3}{8}$	$28\frac{3}{4}$	$20\frac{1}{4}$	$31\frac{1}{2}$	8	2	$3\frac{1}{8}$
12	$10\frac{3}{4}$	$3\frac{1}{2}$	27	$3\frac{1}{2}$	30	21	33	8	2	$3\frac{1}{4}$
$12\frac{1}{2}$	$11\frac{1}{4}$	$3\frac{5}{8}$	28	$3\frac{5}{8}$	$31\frac{1}{4}$	25	$34\frac{1}{2}$	9	3	$3\frac{1}{4}$
13	$11\frac{3}{4}$	$3\frac{3}{4}$	29	$3\frac{3}{4}$	$32\frac{1}{2}$	26	36	9	3	$3\frac{1}{4}$
$13\frac{1}{2}$	$12\frac{1}{4}$	$3\frac{7}{8}$	30	$3\frac{7}{8}$	$33\frac{3}{4}$	27	$37\frac{1}{2}$	9	3	$3\frac{3}{8}$
14	$12\frac{3}{4}$	4	$31\frac{1}{2}$	4	35	28	39	9	3	$3\frac{5}{8}$
$14\frac{1}{2}$	13	$4\frac{1}{8}$	$32\frac{1}{2}$	$4\frac{1}{8}$	$36\frac{1}{4}$	29	40	9	3	$3\frac{3}{4}$
15	$13\frac{1}{2}$	$4\frac{1}{4}$	$33\frac{1}{2}$	$4\frac{1}{4}$	$37\frac{1}{2}$	30	41	9	3	$3\frac{7}{8}$

NOTES.—TABLE 48

1. The width of material in the flanges, or palms of scarphs, outside the bolt holes is not to be less than two thirds of the diameter of the bolt.

2. In scarphed couplings the athwartship dimension at the top of the scarph is not to be less than the diameter of the rudder head. The thickness of the tips of the palms is not to be less than thirteen per cent of the diameter of the rudder head.

TABLE 49 STEERING CHAINS, RODS, QUADRANTS AND TILLERS

DIAMETER OF RUDDER HEAD TABLE 44	DIAMETER OF WROUGHT IRON CHAINS	DIAMETER OF RODS	RADIUS OF QUADRANT	BOSS OF QUADRANT		QUADRANTS AND TILLERS		
				Depth	Outside diameter	Sizes of arms at twice the diameter of rudder head from centre of rudder head		
						One arm	Two arms	Three arms
Inches	Inches	Inches	Feet Inches	Inches	Inches	Inches	Inches	Inches
$3\frac{1}{2}$	$\frac{9}{16}$	$\frac{5}{8}$	3— 2	$3\frac{1}{2}$	$6\frac{1}{4}$	$3\frac{1}{2} \times 2\frac{1}{2}$		
$3\frac{3}{4}$	$\frac{9}{16}$	$\frac{5}{8}$	3— 3	$3\frac{3}{4}$	$6\frac{3}{4}$	$4 \times 2\frac{1}{2}$		
4	$\frac{5}{8}$	$\frac{11}{16}$	3— 4	4	$7\frac{1}{4}$	$4\frac{1}{4} \times 2\frac{1}{2}$		
$4\frac{1}{4}$	$\frac{11}{16}$	$\frac{3}{4}$	3— 5	$4\frac{1}{4}$	$7\frac{1}{2}$	$4\frac{1}{2} \times 2\frac{3}{4}$		
$4\frac{1}{2}$	$\frac{11}{16}$	$\frac{3}{4}$	3— 6	$4\frac{1}{2}$	8	$5 \times 2\frac{3}{4}$	$3\frac{3}{4} \times 2\frac{1}{4}$	
$4\frac{3}{4}$	$\frac{3}{4}$	$\frac{13}{16}$	3— 7	$4\frac{3}{4}$	$8\frac{1}{2}$	$5\frac{1}{4} \times 2\frac{3}{4}$	$4 \times 2\frac{1}{4}$	
5	$\frac{3}{4}$	$\frac{13}{16}$	3— 8	5	9	$5\frac{1}{2} \times 3$	$4\frac{1}{4} \times 2\frac{1}{2}$	
$5\frac{1}{4}$	$\frac{13}{16}$	$\frac{7}{8}$	3— 9	$5\frac{1}{4}$	$9\frac{1}{4}$	$5\frac{3}{4} \times 3$	$4\frac{1}{2} \times 2\frac{1}{2}$	
$5\frac{1}{2}$	$\frac{13}{16}$	$\frac{15}{16}$	3—10	$5\frac{1}{2}$	$9\frac{3}{4}$	$6 \times 3\frac{1}{4}$	$4\frac{3}{4} \times 2\frac{1}{2}$	
$5\frac{3}{4}$	$\frac{7}{8}$	$\frac{15}{16}$	3—11	$5\frac{3}{4}$	$10\frac{1}{4}$	$6\frac{1}{4} \times 3\frac{1}{4}$	$5 \times 2\frac{1}{2}$	
6	$\frac{7}{8}$	1	4— 0	6	$10\frac{3}{4}$	$6\frac{1}{2} \times 3\frac{1}{2}$	$5\frac{1}{4} \times 2\frac{3}{4}$	
$6\frac{1}{4}$	$\frac{15}{16}$	$1\frac{1}{16}$	4— 1	$6\frac{1}{4}$	$11\frac{1}{4}$	$6\frac{3}{4} \times 3\frac{1}{2}$	$5\frac{1}{2} \times 2\frac{3}{4}$	
$6\frac{1}{2}$	$\frac{15}{16}$	$1\frac{1}{16}$	4— 2	$6\frac{1}{2}$	$11\frac{3}{4}$	$7 \times 3\frac{3}{4}$	$5\frac{1}{2} \times 3$	
$6\frac{3}{4}$	1	$1\frac{1}{8}$	4— 3	$6\frac{3}{4}$	12	$7\frac{1}{4} \times 3\frac{3}{4}$	$5\frac{3}{4} \times 3$	
7	1	$1\frac{1}{4}$	4— 4	7	$12\frac{1}{2}$	$7\frac{1}{2} \times 4$	$6 \times 3\frac{1}{4}$	
$7\frac{1}{4}$	$1\frac{1}{16}$	$1\frac{1}{4}$	4— 5	$7\frac{1}{4}$	13	$7\frac{3}{4} \times 4\frac{1}{4}$	$6 \times 3\frac{1}{4}$	
$7\frac{1}{2}$	$1\frac{1}{16}$	$1\frac{5}{16}$	4— 6	$7\frac{1}{2}$	$13\frac{1}{2}$	$8 \times 4\frac{1}{2}$	$6\frac{1}{4} \times 3\frac{1}{2}$	
$7\frac{3}{4}$	$1\frac{1}{8}$	$1\frac{3}{8}$	4— 7	$7\frac{3}{4}$	14	$8\frac{1}{4} \times 4\frac{1}{2}$	$6\frac{1}{4} \times 3\frac{3}{4}$	
8	$1\frac{3}{16}$	$1\frac{3}{8}$	4— 8	8	$14\frac{1}{2}$	$8\frac{1}{2} \times 4\frac{3}{4}$	$6\frac{1}{2} \times 4$	$5\frac{3}{4} \times 3\frac{1}{2}$
$8\frac{1}{2}$	$1\frac{1}{4}$	$1\frac{1}{2}$	5— 0	$8\frac{1}{2}$	$15\frac{1}{4}$	9×5	7×4	$6 \times 3\frac{3}{4}$
9	$1\frac{5}{16}$	$1\frac{9}{16}$	5— 4	9	$16\frac{1}{4}$	$9\frac{1}{2} \times 5\frac{1}{4}$	$7\frac{1}{2} \times 4\frac{1}{4}$	$6\frac{1}{2} \times 3\frac{3}{4}$
$9\frac{1}{2}$	$1\frac{3}{8}$	$1\frac{11}{16}$	5— 8	$9\frac{1}{2}$	17	$10 \times 5\frac{3}{4}$	$8 \times 4\frac{1}{2}$	7×4
10	$1\frac{7}{16}$	$1\frac{3}{4}$	6— 0	10	18	$10\frac{1}{2} \times 6$	$8\frac{1}{2} \times 4\frac{1}{2}$	$7\frac{1}{2} \times 4$
$10\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{7}{8}$	6— 4	$10\frac{1}{2}$	19	$11 \times 6\frac{1}{4}$	$9 \times 4\frac{3}{4}$	8×4
11	$1\frac{9}{16}$	$1\frac{15}{16}$	6— 8	11	$19\frac{3}{4}$	$11\frac{1}{2} \times 6\frac{3}{4}$	$9\frac{1}{2} \times 5$	$8\frac{1}{2} \times 4\frac{1}{2}$
$11\frac{1}{2}$	$1\frac{5}{8}$	$1\frac{15}{16}$	7— 0	$11\frac{1}{2}$	$20\frac{3}{4}$	12×7	$10 \times 5\frac{1}{4}$	$8\frac{1}{2} \times 5$
12	$1\frac{5}{8}$	2	7— 4	12	$21\frac{1}{2}$	$12\frac{1}{2} \times 7\frac{1}{2}$	$10\frac{1}{2} \times 5\frac{1}{2}$	9×5
$12\frac{1}{2}$			7— 8	$12\frac{1}{2}$	$22\frac{1}{2}$	$13 \times 7\frac{1}{2}$	$11 \times 5\frac{1}{2}$	$9\frac{1}{2} \times 5$
13			8— 0	13	$23\frac{1}{2}$	$13\frac{1}{2} \times 7\frac{1}{2}$	$11\frac{1}{4} \times 5\frac{3}{4}$	10×5
$13\frac{1}{2}$			8— 0	$13\frac{1}{2}$	$24\frac{1}{2}$	14×8	$11\frac{1}{2} \times 6$	$10 \times 5\frac{1}{4}$
14			8— 0	14	$25\frac{1}{4}$	$14\frac{1}{2} \times 8$	12×6	$10\frac{1}{2} \times 5\frac{1}{4}$
$14\frac{1}{2}$			8— 0	$14\frac{1}{2}$	$26\frac{1}{4}$	$15 \times 8\frac{1}{2}$	$12\frac{1}{4} \times 6\frac{1}{2}$	$10\frac{1}{2} \times 5\frac{1}{2}$
15			8— 0	15	27	$15\frac{1}{2} \times 8\frac{1}{2}$	$12\frac{3}{4} \times 6\frac{1}{2}$	$11 \times 5\frac{1}{2}$

NOTE—TABLE 49

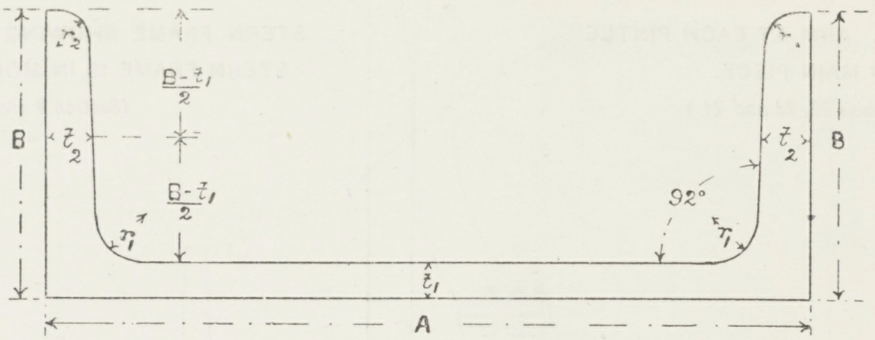
Where special steel short link chains (*see* P 1301 Grade III) are used, the diameter given in column 2 above may be reduced as follows:—

Table size inches	*Reduction inches*
$\frac{15}{16}$ and below	$\frac{1}{16}$
1 — $1\frac{3}{16}$	$\frac{1}{8}$
$1\frac{1}{4}$ — $1\frac{5}{8}$	$\frac{3}{16}$

BRITISH STANDARD SECTIONS.

CHANNELS.

(NOTE:—The Sections marked thus * are additional to the British Standard Sections.)



Size.	Thickness at Correct Standard Profile.		Web thickness.		Radii.	
Web and Flanges.	Web.	Flange.	Maximum rolled.	Minimum rolled.	Root.	Toe.
A × B × B	t_1	t_2			r_1	r_2
Inches.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.
6 × 3 × 3	·375	·475	·575	·350	·475	·325
6 × 3½ × 3½	·375	·475	·575	·350	·475	·325
7 × 3 × 3	·375	·475	·575	·350	·475	·325
7 × 3½ × 3½	·400	·500	·600	·350	·500	·350
*7½ × 3 × 3	·400	·500	·600	·350	·500	·350
*7½ × 3½ × 3½	·400	·500	·600	·350	·500	·350
*8 × 3 × 3	·400	·500	·600	·350	·500	·350
8 × 3½ × 3½	·425	·525	·625	·375	·525	·375
8 × 4 × 4	·450	·550	·650	·400	·550	·375
*8½ × 3 × 3	·425	·525	·625	·375	·525	·375
*8½ × 3½ × 3½	·450	·550	·650	·400	·550	·375
9 × 3½ × 3½	·450	·550	·650	·400	·550	·375
9 × 4 × 4	·475	·575	·675	·425	·575	·400
*9½ × 3½ × 3½	·450	·550	·650	·400	·550	·375
10 × 3½ × 3½	·475	·575	·675	·425	·575	·400
10 × 4 × 4	·475	·575	·675	·425	·575	·400
*10½ × 3½ × 3½	·475	·575	·675	·425	·575	·400
11 × 3½ × 3½	·475	·575	·675	·425	·575	·400
11 × 4 × 4	·500	·600	·700	·450	·600	·425
*11½ × 3½ × 3½	·500	·600	·700	·450	·600	·425
12 × 3½ × 3½	·500	·600	·700	·450	·600	·425
12 × 4 × 4	·525	·625	·725	·475	·625	·425
*13 × 4 × 4	·525	·625	·725	·475	·625	·425
*14 × 4 × 4	·525	·625	·725	·475	·625	·425
*15 × 4 × 4	·525	·625	·725	·475	·625	·425

The Standard thickness of flanges of Channel bar is to be measured at distances half-way between the extreme edges of the flanges and the nearer side of the web.

The web of Channel bars can vary in thickness between the limits shown in the Table, but the thickness of flange remains constant.

LONDON.—*6th May, 1915.*

Size.	A	Thickness at Correct Standard Profile
*5 Inches.	Inch.	
6	·300	5 — 4
7	·350	5 — 8
8	·400	6 — 0
9	·450	6 — 4
10	·500	6 — 8
11	·550	7 — 0
12	·600	7 — 4
		7 — 8
		8 — 0
		8 — 0
		8 — 0
		8 — 0

	$1\frac{5}{16}$	$1\frac{9}{16}$	5 — 4	9	$16\frac{1}{4}$	$9\frac{1}{2} \times 5\frac{1}{4}$	$7\frac{1}{2} \times 4\frac{1}{4}$
$9\frac{1}{2}$	$1\frac{3}{8}$	$1\frac{11}{16}$	5 — 8	$9\frac{1}{2}$	17	10 × $5\frac{3}{4}$	8 × $4\frac{1}{2}$
10	$1\frac{7}{16}$	$1\frac{3}{4}$	6 — 0	10	18	$10\frac{1}{2} \times 6$	$8\frac{1}{2} \times 4\frac{1}{2}$
$10\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{7}{8}$	6 — 4	$10\frac{1}{2}$	19	11 × $6\frac{1}{4}$	9 × $4\frac{3}{4}$
11	$1\frac{9}{16}$	$1\frac{15}{16}$	6 — 8	11	$19\frac{3}{4}$	$11\frac{1}{2} \times 6\frac{3}{4}$	$9\frac{1}{2} \times 5$
$11\frac{1}{2}$	$1\frac{5}{8}$	$1\frac{15}{16}$	7 — 0	$11\frac{1}{2}$	$20\frac{3}{4}$	12 × 7	10 × $5\frac{1}{4}$
12	$1\frac{5}{8}$	2	7 — 4	12	$21\frac{1}{2}$	$12\frac{1}{2} \times 7\frac{1}{2}$	$10\frac{1}{2} \times 5\frac{1}{2}$
$12\frac{1}{2}$			7 — 8	$12\frac{1}{2}$	$22\frac{1}{2}$	13 × $7\frac{1}{2}$	11 × $5\frac{1}{2}$
13			8 — 0	13	$23\frac{1}{2}$	$13\frac{1}{2} \times 7\frac{1}{2}$	$11\frac{1}{4} \times 5\frac{3}{4}$
$13\frac{1}{2}$			8 — 0	$13\frac{1}{2}$	$24\frac{1}{2}$	14 × 8	$11\frac{1}{2} \times 6$
14			8 — 0	14	$25\frac{1}{4}$	$14\frac{1}{2} \times 8$	12 × 6
$14\frac{1}{2}$			8 — 0	$14\frac{1}{2}$	$26\frac{1}{4}$	15 × $8\frac{1}{2}$	$12\frac{1}{4} \times 6\frac{1}{2}$
15			8 — 0	15	27	$15\frac{1}{2} \times 8\frac{1}{2}$	$12\frac{3}{4} \times 6\frac{1}{2}$

(NOTE:—The

	× $5\frac{3}{4}$
$7\frac{1}{2}$	× $4\frac{1}{4}$
8	× $4\frac{1}{2}$
$8\frac{1}{2}$	× $4\frac{1}{2}$
9	× $4\frac{3}{4}$
$9\frac{1}{2}$	× 5
10	× $5\frac{1}{4}$
$10\frac{1}{2}$	× $5\frac{1}{2}$
11	× $5\frac{1}{2}$
$11\frac{1}{4}$	× $5\frac{3}{4}$
$11\frac{1}{2}$	× 6
12	× 6
$12\frac{1}{4}$	× $6\frac{1}{2}$
$12\frac{3}{4}$	× $6\frac{1}{2}$

$6\frac{1}{2}$	× $3\frac{3}{4}$
7	× 4
$7\frac{1}{2}$	× 4
8	× 4
$8\frac{1}{2}$	× $4\frac{1}{2}$
$8\frac{1}{2}$	× 5
9	× 5
$9\frac{1}{2}$	× 5
10	× 5
10	× $5\frac{1}{4}$
$10\frac{1}{2}$	× $5\frac{1}{4}$
$10\frac{1}{2}$	× $5\frac{1}{2}$
11	× $5\frac{1}{2}$

NOTE—TABLE 49

Where special steel short link chains (*see* P 1301 Grade III) are used, the diameter given in column 2 above may be reduced as follows:—

Table size inches	*Reduction* inches
$\frac{15}{16}$ and below	$\frac{1}{16}$
1 — $1\frac{3}{16}$	$\frac{1}{8}$
$1\frac{1}{4}$ — $1\frac{5}{8}$	$\frac{3}{16}$

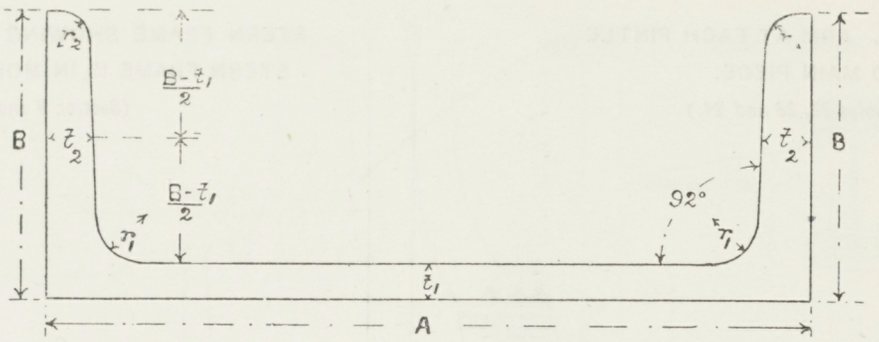
Radii.			Minimum thickness.
Root.	Toe.		Minimum rolled.
r_1	r_2		
Inch.	Inch.		Inch.
·325	·225		·300
·300	·200		·150
·325	·225		·175
·350	·225		·325
·375	·250		·350
·425	·300		·375
·450	·300		·400
·450	·325		·425
·475	·350		·450
·500	·350		·475

Standard thickness, the increase ...nerally, for each ·05 inch increase ...5 inch.

BRITISH STANDARD SECTIONS.

CHANNELS.

(NOTE:—The Sections marked thus * are additional to the British Standard Sections.)



Size.	Thickness at Correct Standard Profile.		Web thickness.		Radii.	
Web and Flanges.	Web.	Flange.	Maximum rolled.	Minimum rolled.	Root.	Toe.
A × B × B	t_1	t_2			r_1	r_2
Inches.	Inch.	Inch.	Inch.	Inch.	Inch.	Inch.
6 × 3 × 3	·375	·475	·575	·350	·475	·325
6 × 3½ × 3½	·375	·475	·575	·350	·475	·325
7 × 3 × 3	·375	·475	·575	·350	·475	·325
7 × 3½ × 3½	·400	·500	·600	·350	·500	·350
*7½ × 3 × 3	·400	·500	·600	·350	·500	·350
*7½ × 3½ × 3½	·400	·500	·600	·350	·500	·350
*8 × 3 × 3	·400	·500	·600	·350	·500	·350
8 × 3½ × 3½	·425	·525	·625	·375	·525	·375
8 × 4 × 4	·450	·550	·650	·400	·550	·375
*8½ × 3 × 3	·425	·525	·625	·375	·525	·375
*8½ × 3½ × 3½	·450	·550	·650	·400	·550	·375
9 × 3½ × 3½	·450	·550	·650	·400	·550	·375
9 × 4 × 4	·475	·575	·675	·425	·575	·400
*9½ × 3½ × 3½	·450	·550	·650	·400	·550	·375
10 × 3½ × 3½	·475	·575	·675	·425	·575	·400
10 × 4 × 4	·475	·575	·675	·425	·575	·400
*10½ × 3½ × 3½	·475	·575	·675	·425	·575	·400
11 × 3½ × 3½	·475	·575	·675	·425	·575	·400
11 × 4 × 4	·500	·600	·700	·450	·600	·425
*11½ × 3½ × 3½	·500	·600	·700	·450	·600	·425
12 × 3½ × 3½	·500	·600	·700	·450	·600	·425
12 × 4 × 4	·525	·625	·725	·475	·625	·425
*13 × 4 × 4	·525	·625	·725	·475	·625	·425
*14 × 4 × 4	·525	·625	·725	·475	·625	·425
*15 × 4 × 4	·525	·625	·725	·475	·625	·425

The Standard thickness of flanges of Channel bar is to be measured at distances half-way between the extreme edges of the flanges and the nearer side of the web.

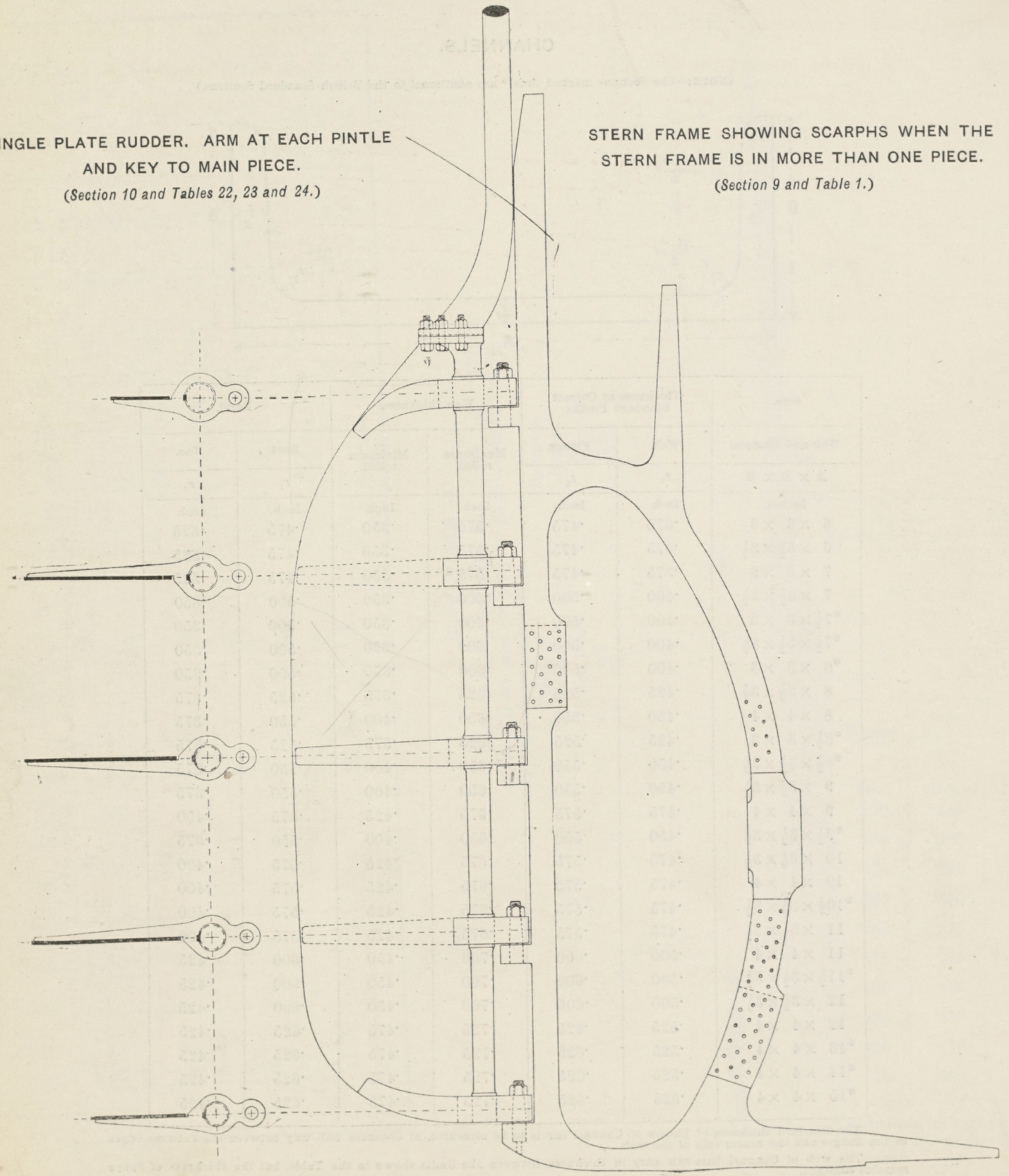
The web of Channel bars can vary in thickness between the limits shown in the Table, but the thickness of flange remains constant.

LONDON.—*6th May, 1915.*

SINGLE PLATE RUDDER AND STERN FRAME.

SINGLE PLATE RUDDER. ARM AT EACH PINTLE AND KEY TO MAIN PIECE.
(Section 10 and Tables 22, 23 and 24.)

STERN FRAME SHOWING SCARPHS WHEN THE STERN FRAME IS IN MORE THAN ONE PIECE.
(Section 9 and Table 1.)

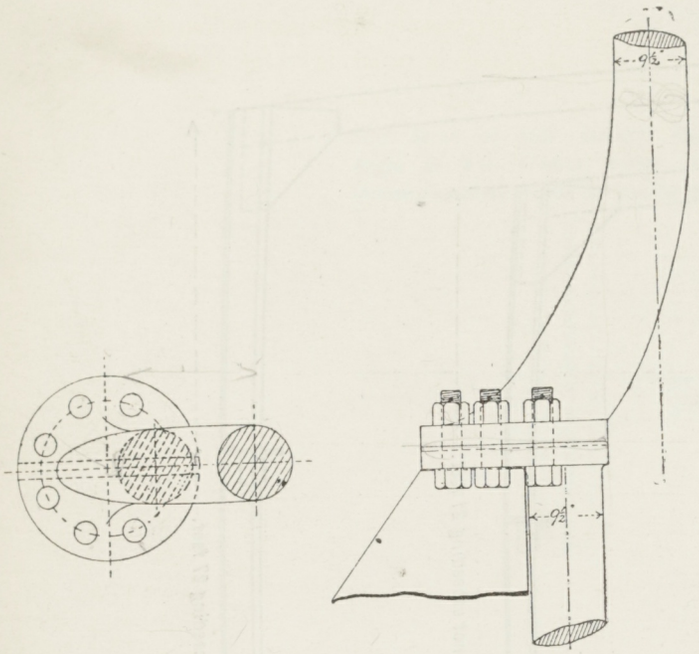


COUPLINGS OF RUDDER HEADS.

Horizontal Coupling of Rudder Head.

(Section 10 and Table 23.)

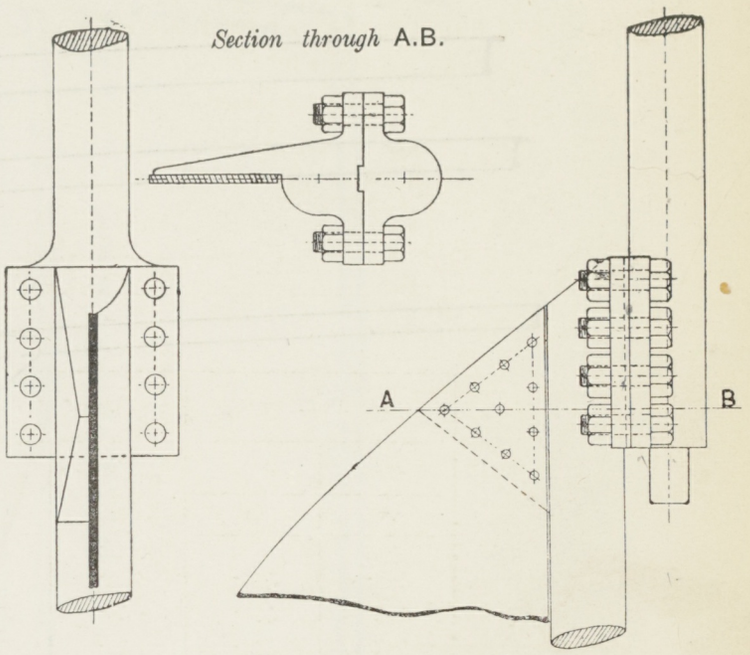
Rudder Head 9½ inches diameter.



Vertical Coupling of Rudder Head.

(Section 10 and Table 23.)

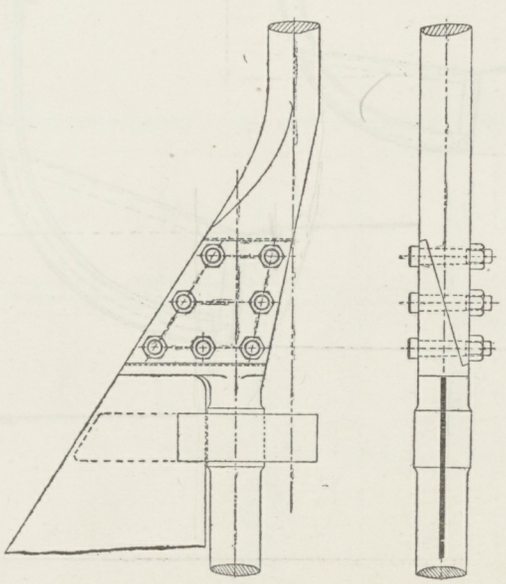
Rudder Head 9½ inches diameter.



Scarphed Coupling of Rudder Head.

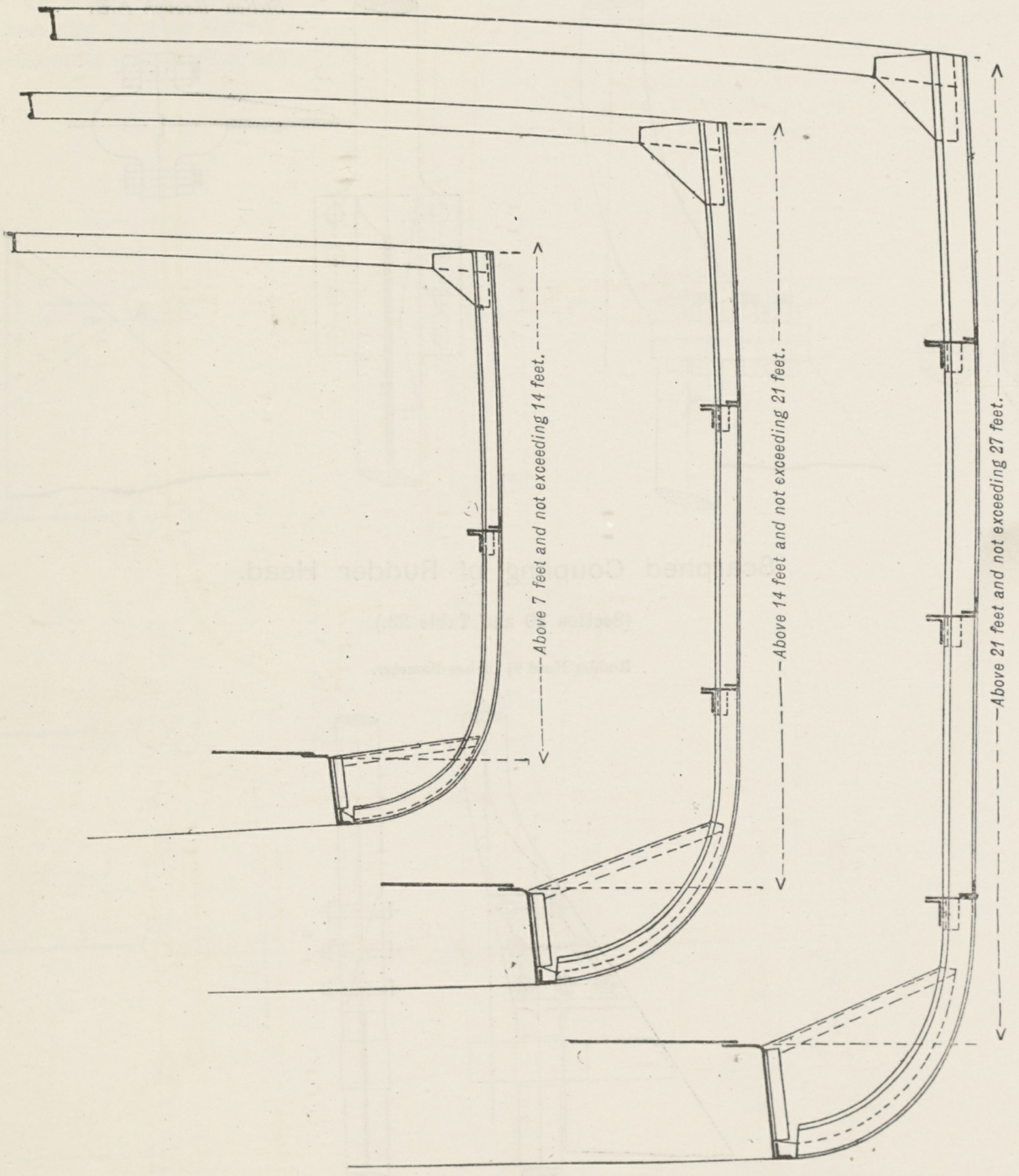
(Section 10 and Table 23.)

Rudder Head 9½ inches diameter.



ARRANGEMENT OF SIDE STRINGERS.

(Section 15 and Tables 2, 3 & 7.)



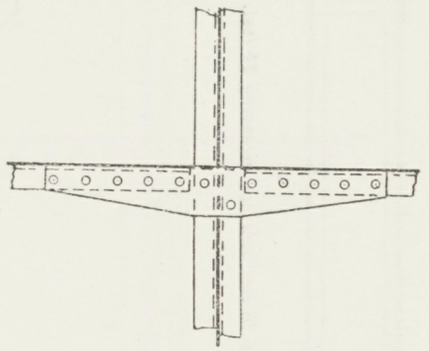
ARRANGEMENT OF WEB FRAMES AND SIDE STRINGERS.

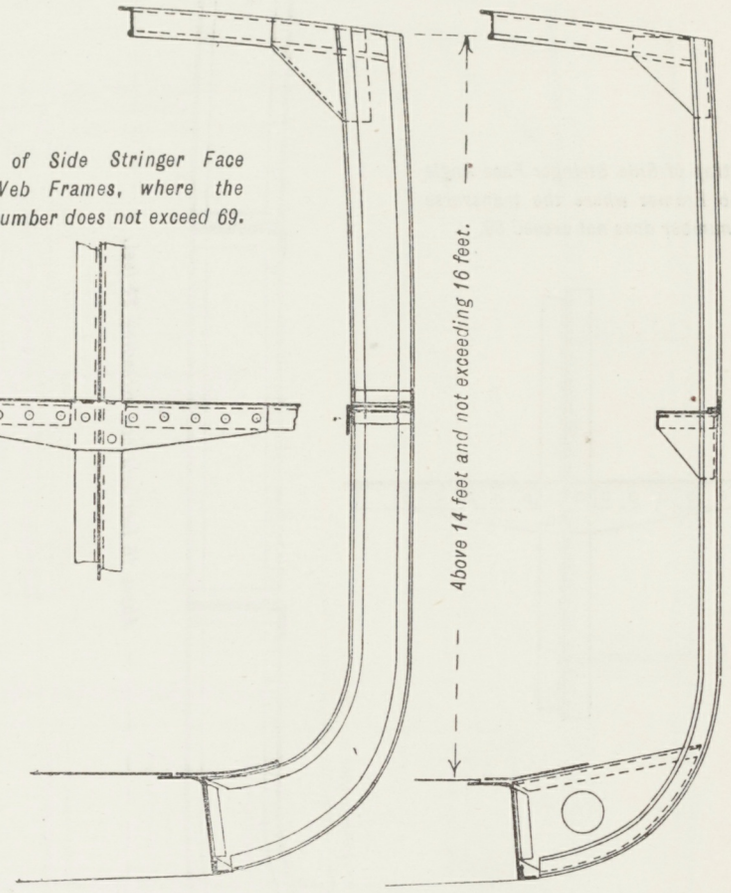
(Section 13 and Table 5.)

Section at Web Frame.

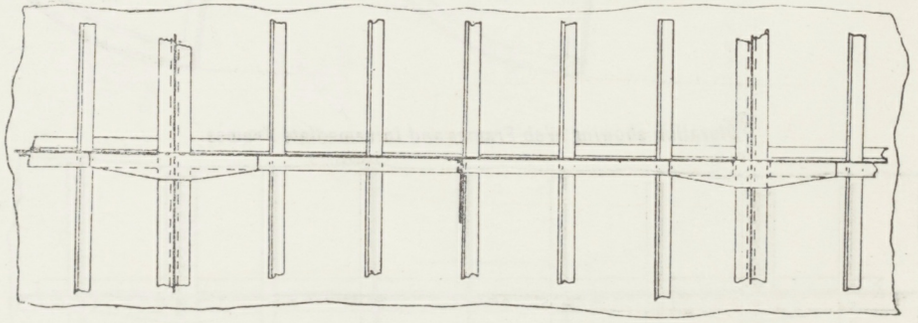
Section at Intermediate Frame with Bracket under Side Stringer.

Butt Strap of Side Stringer Face Angle at Web Frames, where the transverse number does not exceed 69.



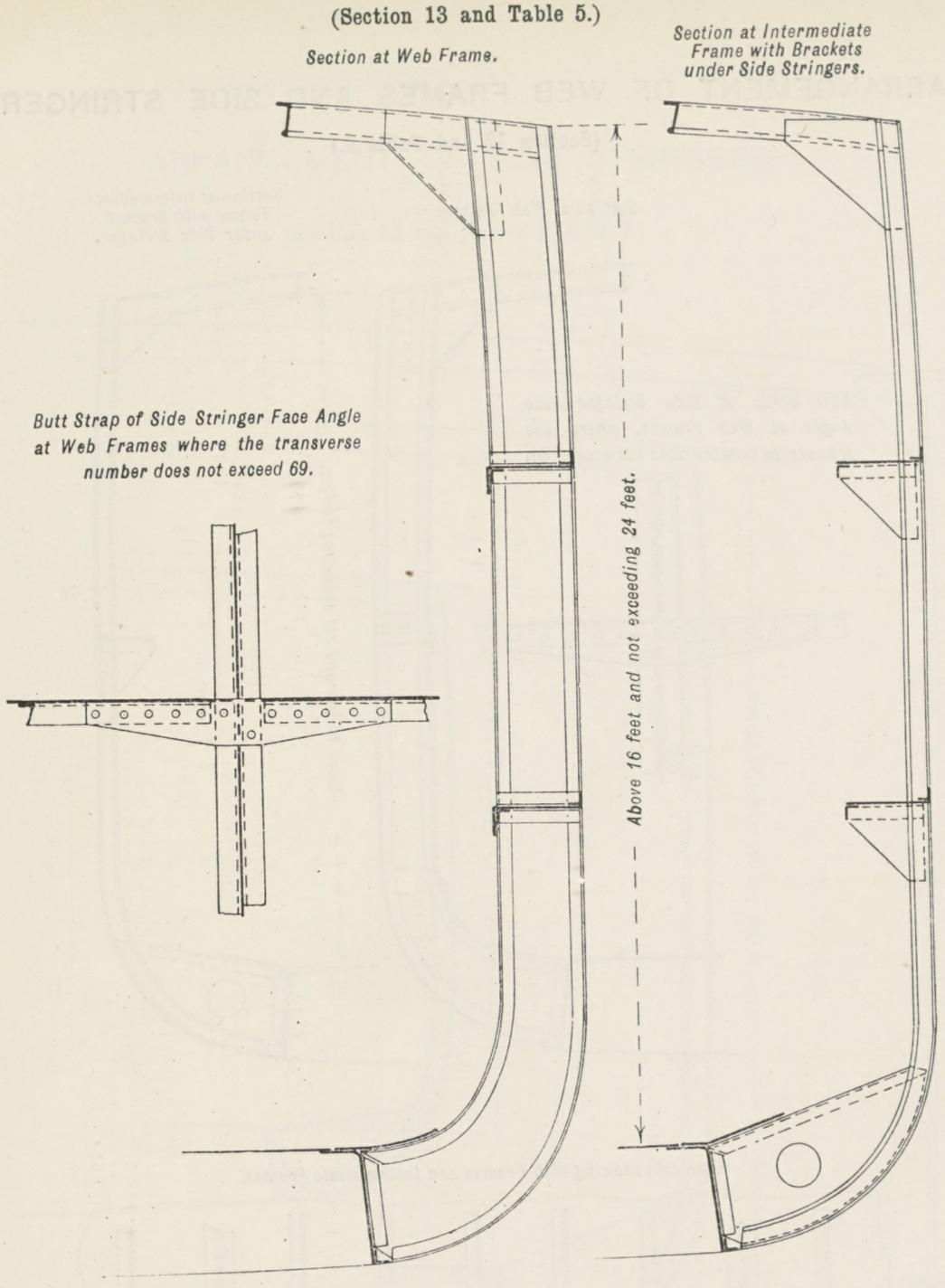


Elevation showing Web Frames and Intermediate Frames.

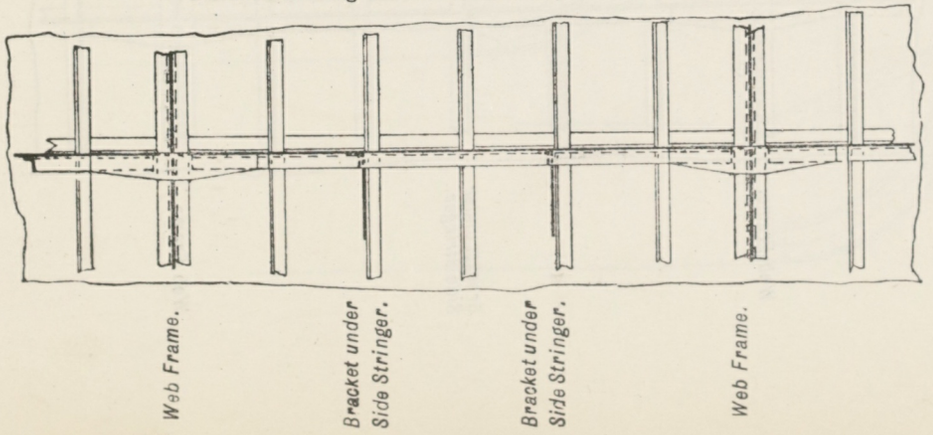


ARRANGEMENT OF WEB FRAMES AND SIDE STRINGERS.

(Section 13 and Table 5.)

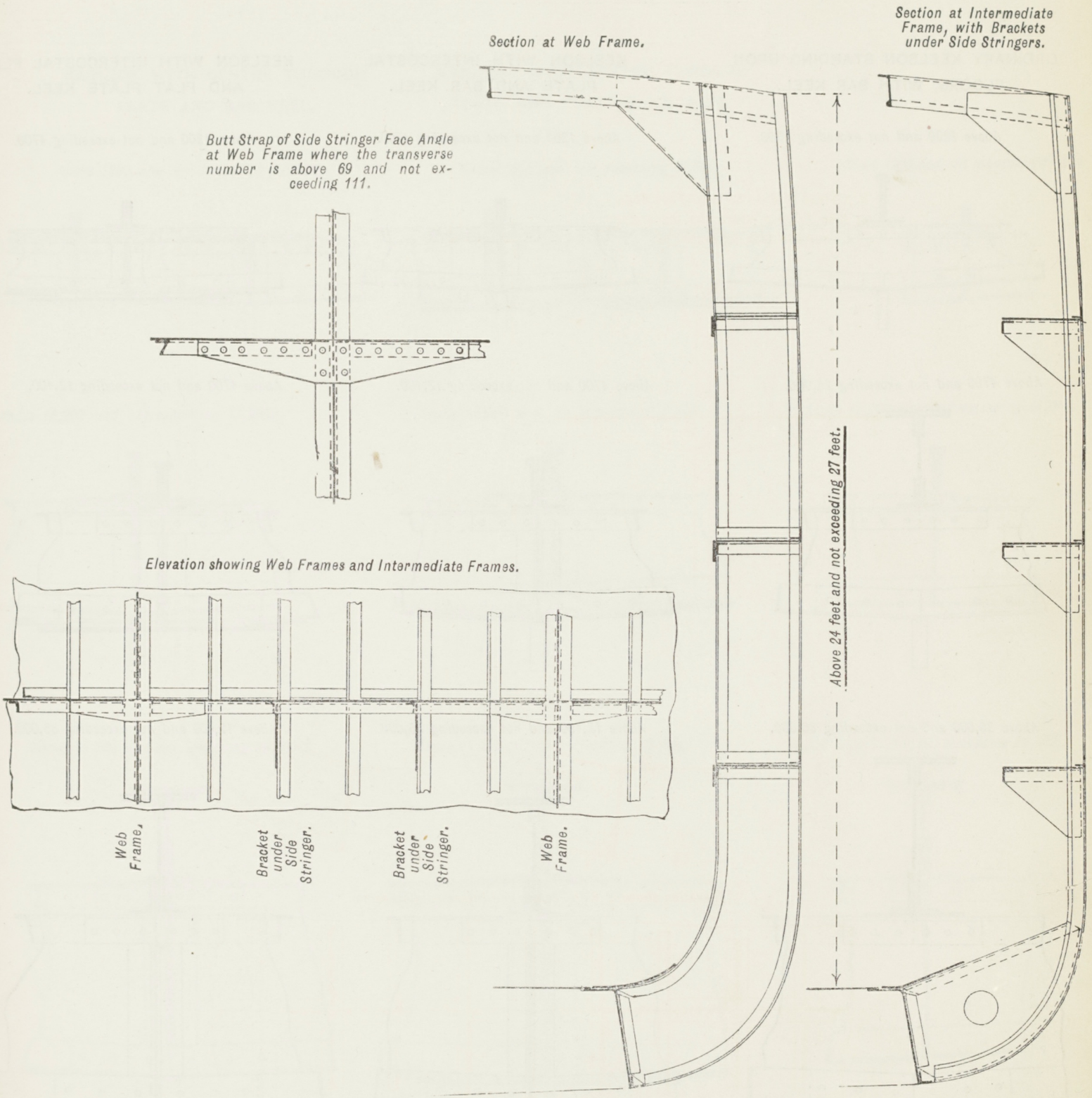


Elevation showing Web Frames and Intermediate Frames.



ARRANGEMENT OF WEB FRAMES AND SIDE STRINGERS.

(Section 13 and Table 5.)

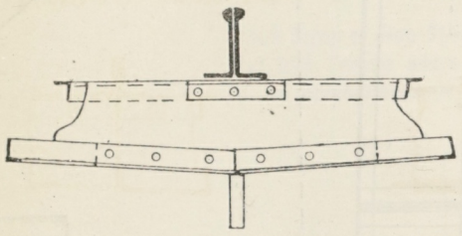


MIDDLE LINE KEELSONS.

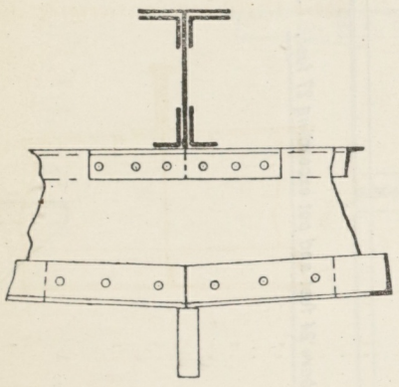
(Section 14 and Table 6.)

ORDINARY KEELSON STANDING UPON FLOORS, WITH BAR KEEL.

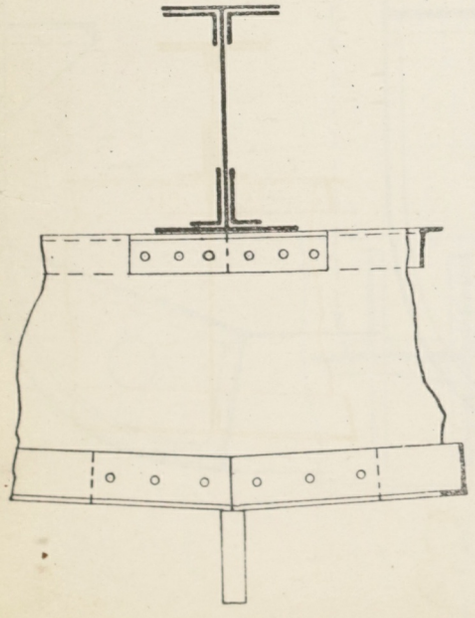
Above 1200 and not exceeding 4700.



Above 4700 and not exceeding 26,000.

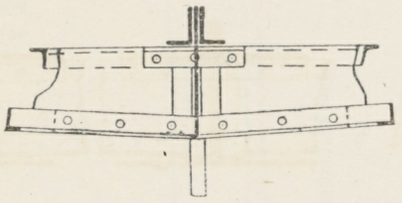


Above 26,000 and not exceeding 36,000.

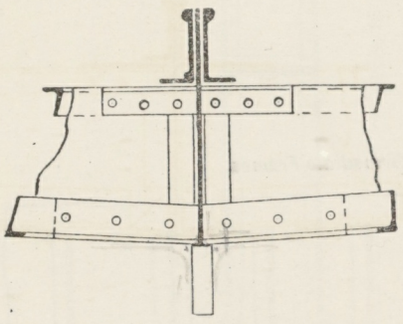


KEELSON WITH INTERCOSTAL PLATE AND BAR KEEL.

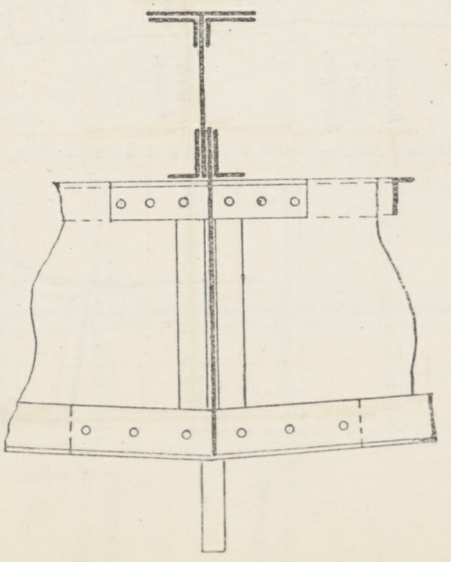
Above 1200 and not exceeding 4700.



Above 4700 and not exceeding 12,400.

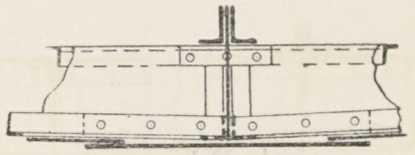


Above 12,400 and not exceeding 36,000.

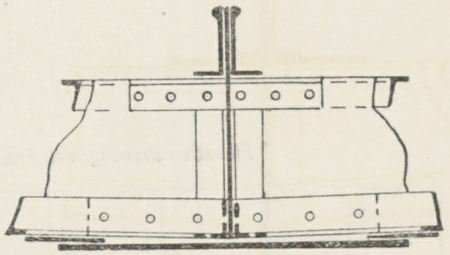


KEELSON WITH INTERCOSTAL PLATE AND FLAT PLATE KEEL.

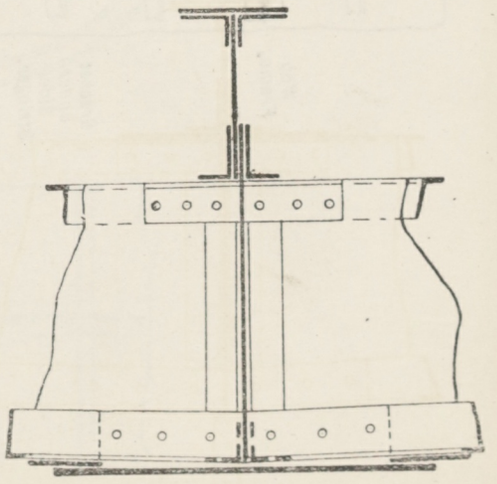
Above 1200 and not exceeding 4700.



Above 4700 and not exceeding 12,400.



Above 12,400 and not exceeding 36,000.



MIDDLE LINE KEELSONS.

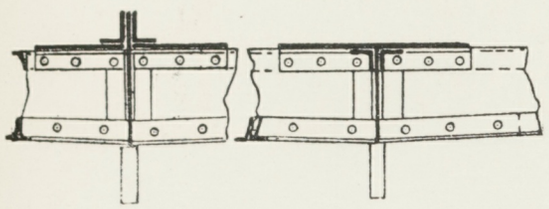
(Section 14 and Table 6.)

SIDE KEELSONS.

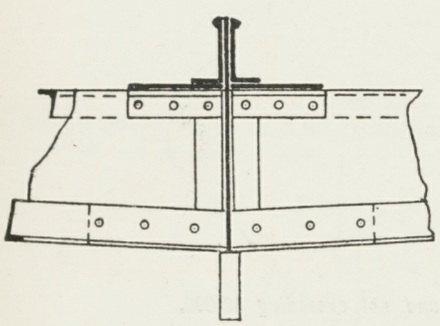
(Section 14 and Table 6.)

KEELSON WITH CENTRE THROUGH PLATE AND BAR KEEL.

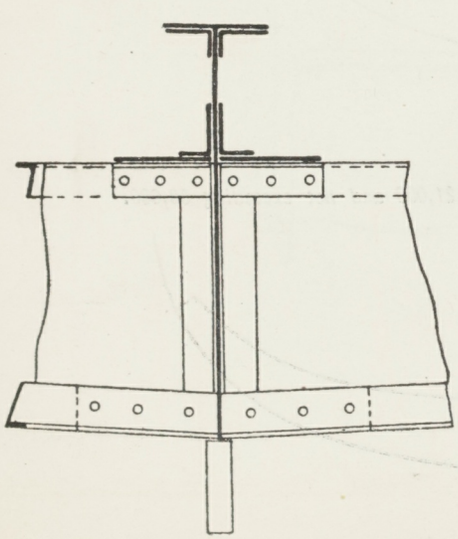
Above 1200 and not exceeding 10,000.



Above 10,000 and not exceeding 17,200.

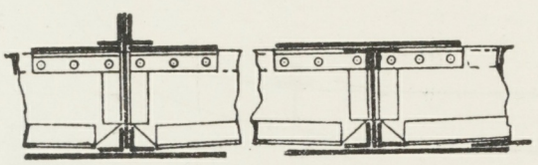


Above 17,200 and not exceeding 36,000.

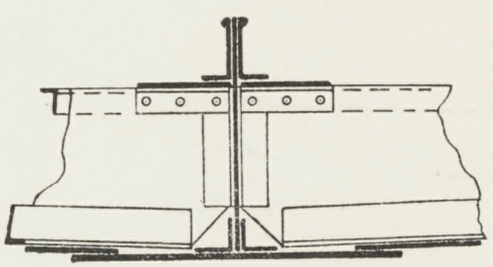


KEELSON WITH CENTRE THROUGH PLATE AND FLAT PLATE KEEL.

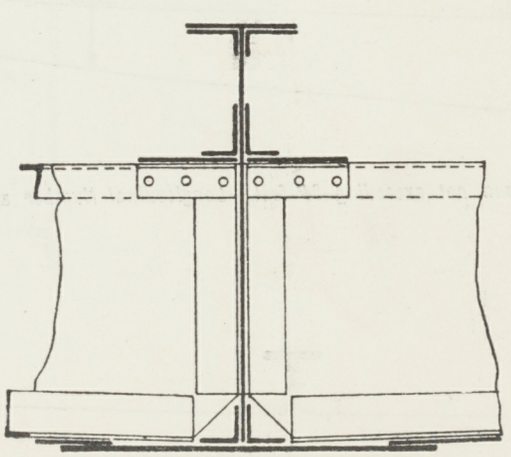
Above 1200 and not exceeding 10,000.



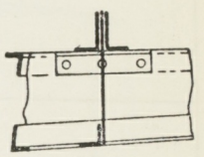
Above 10,000 and not exceeding 17,200.



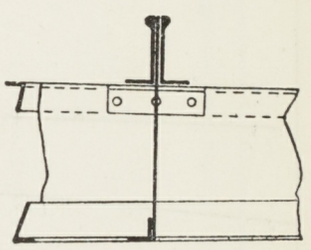
Above 17,200 and not exceeding 36,000.



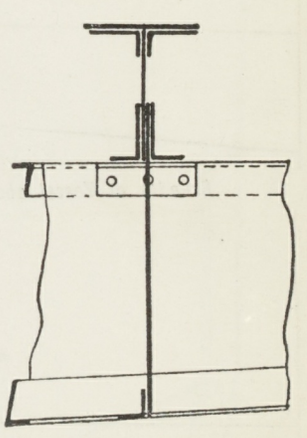
Above 1200 and not exceeding 17,200.



Above 17,200 and not exceeding 21,000.



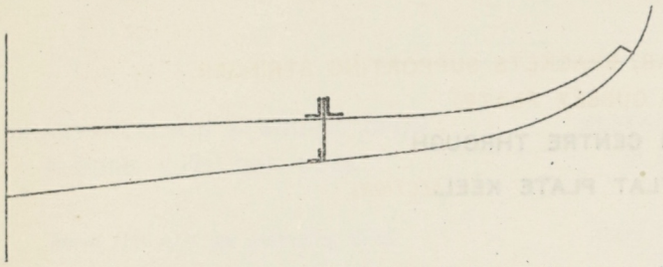
Above 21,000 and not exceeding 36,000.



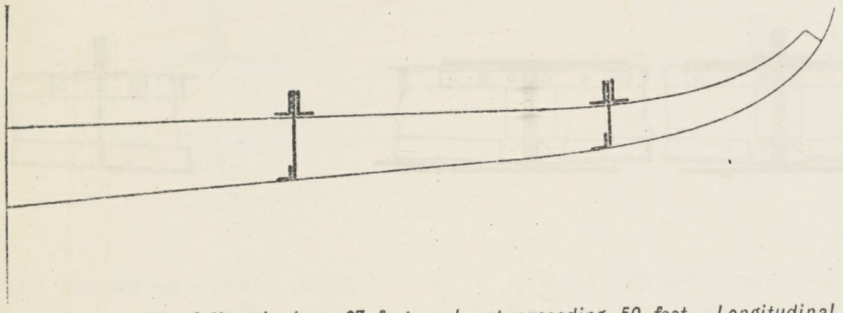
SIDE AND BILGE KEELSONS.

(Section 14 and Table 6.)

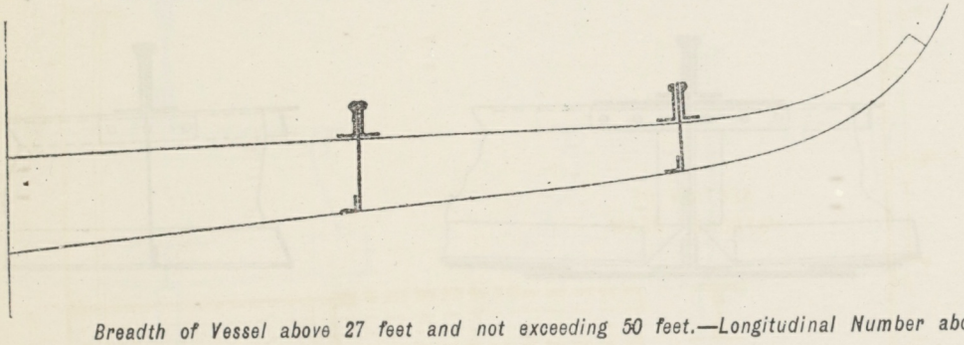
Breadth of Vessel not exceeding 27 feet.



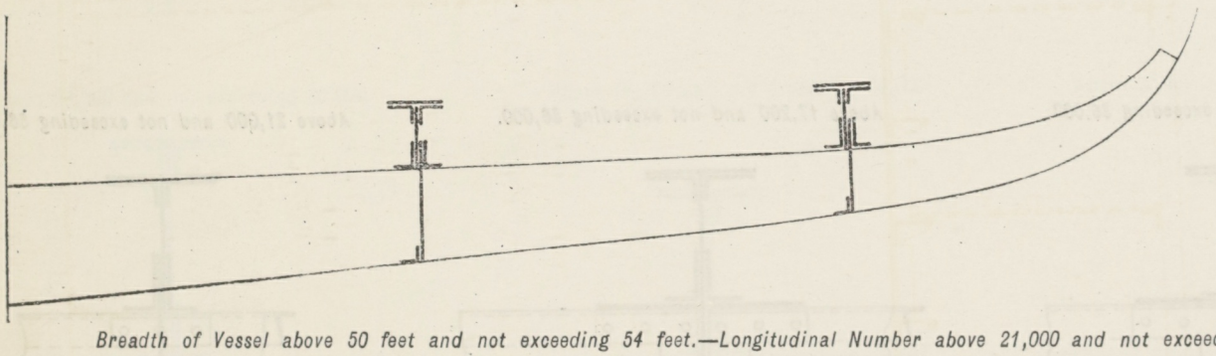
Breadth of Vessel above 27 feet and not exceeding 50 feet.—Longitudinal Number not exceeding 17,200.



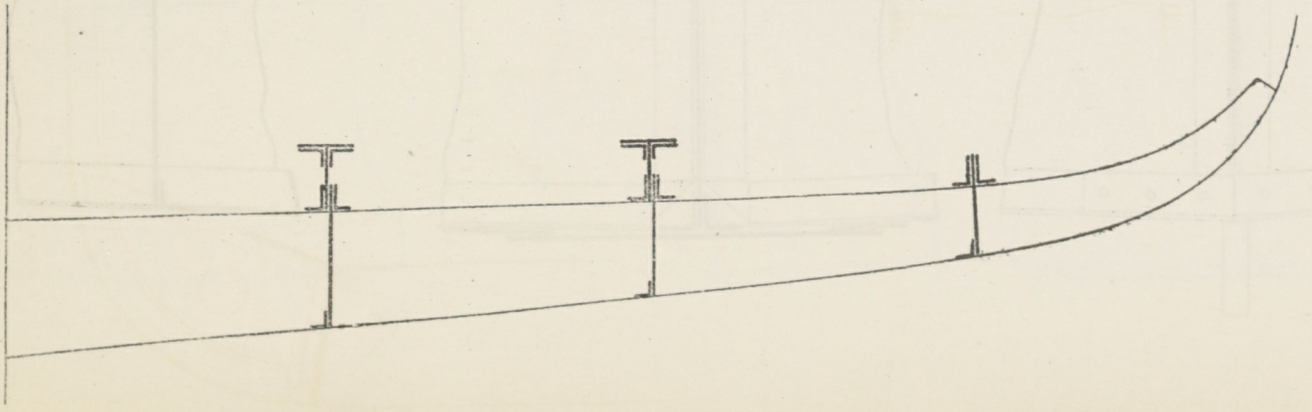
Breadth of Vessel above 27 feet and not exceeding 50 feet.—Longitudinal Number above 17,200 and not exceeding 21,000.



Breadth of Vessel above 27 feet and not exceeding 50 feet.—Longitudinal Number above 21,000 and not exceeding 36,000.



Breadth of Vessel above 50 feet and not exceeding 54 feet.—Longitudinal Number above 21,000 and not exceeding 36,000.

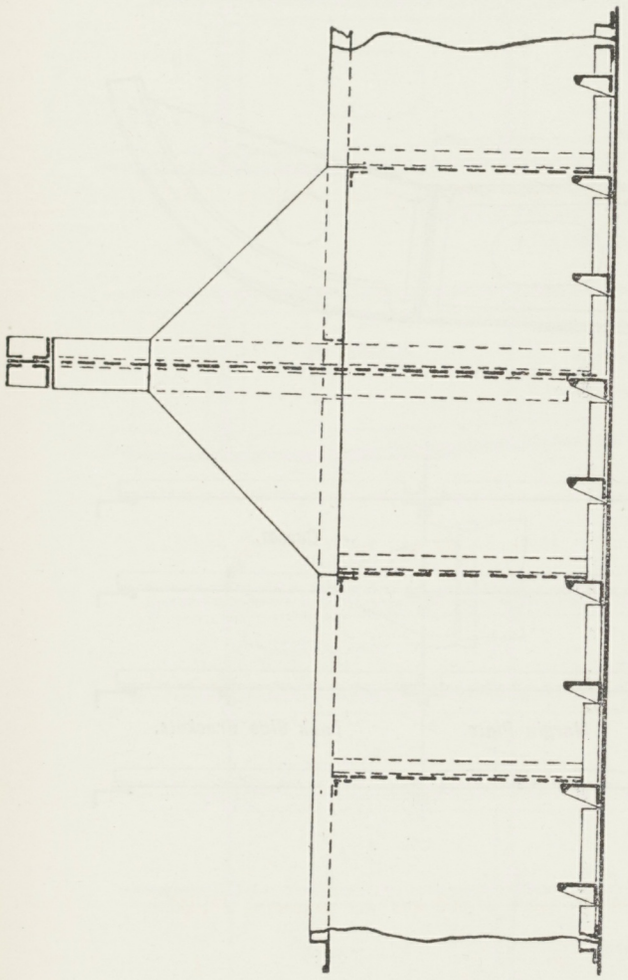


WIDELY SPACED BEAMS IN HOLD.

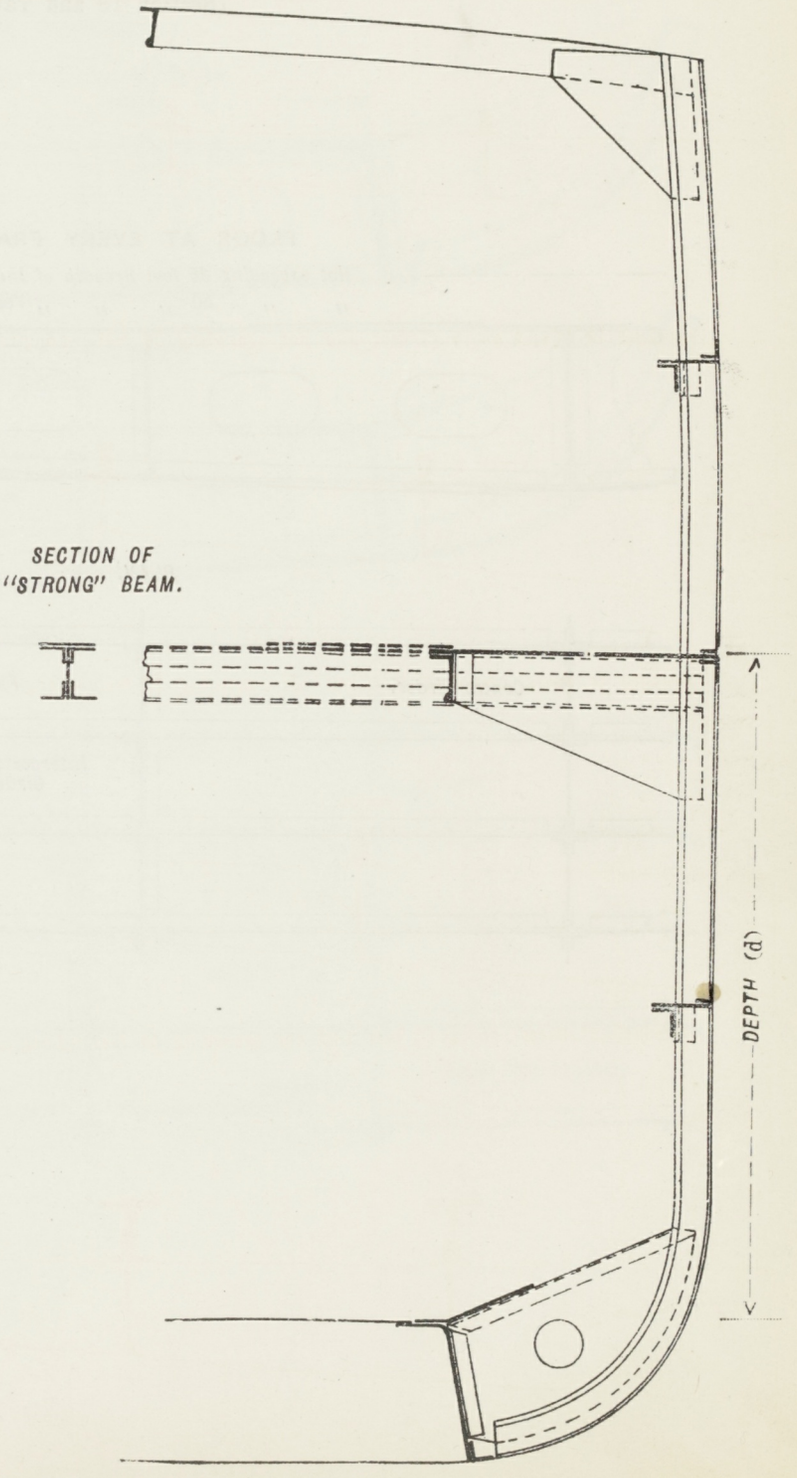
(Section 21 and Table 12.)

SKETCH SHOWING BROAD HOLD STRINGER, FACE BAR, BRACKETS SUPPORTING STRINGER, "STRONG" HOLD BEAMS AND GUSSET PLATE.

PLAN OF BROAD HOLD STRINGER.

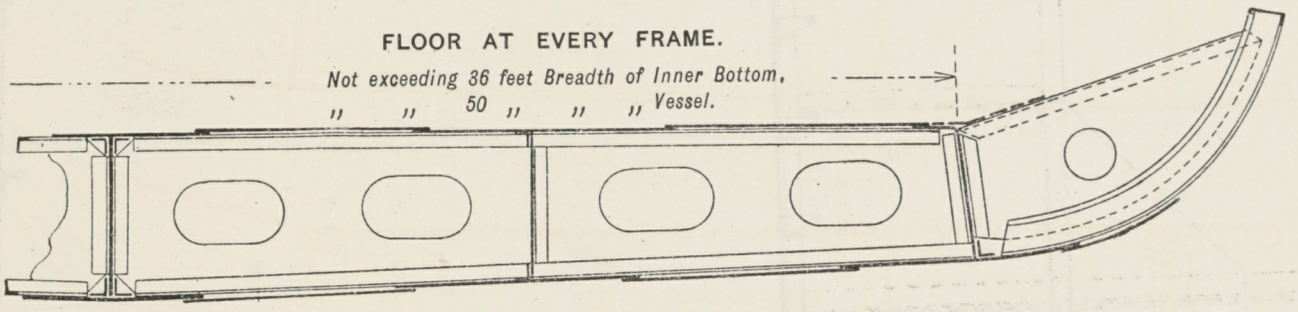


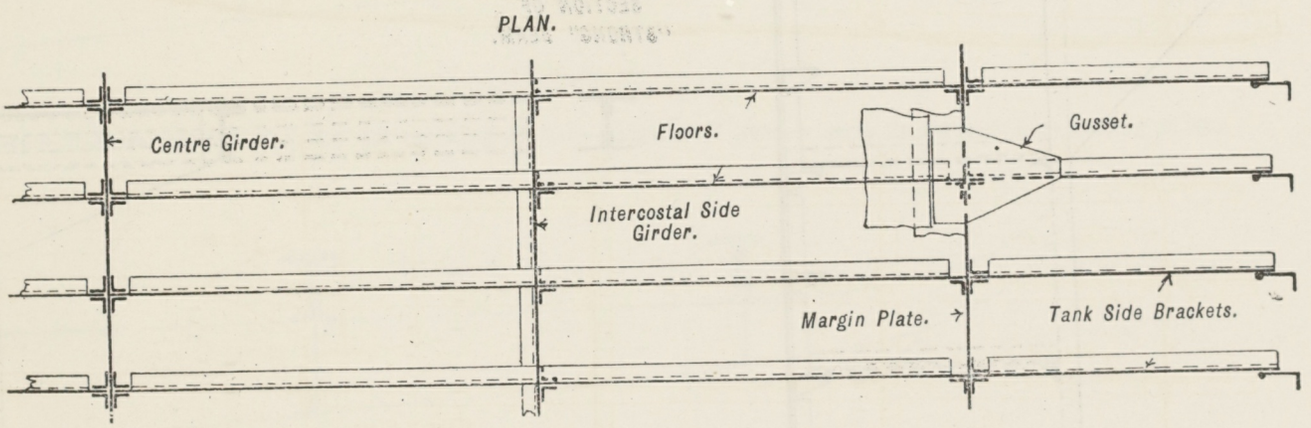
SECTION.



CELLULAR DOUBLE BOTTOMS.

(Section 16 and Tables 8 & 9.)



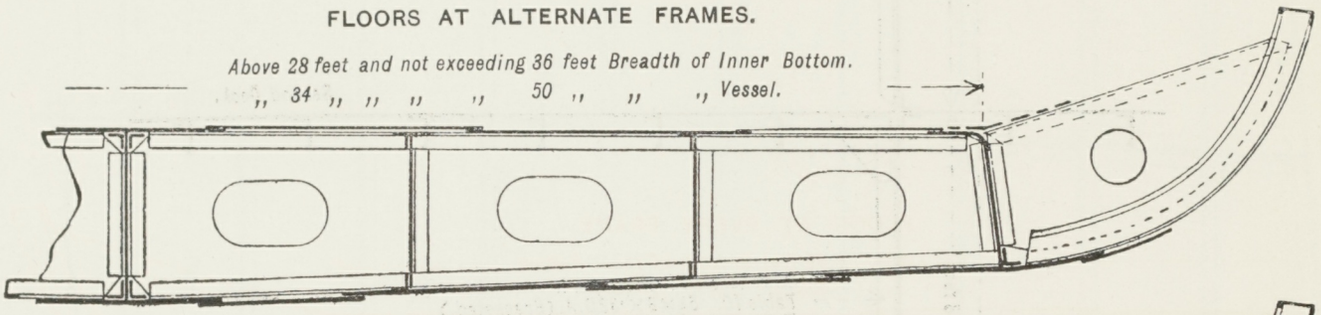


CELLULAR DOUBLE BOTTOMS.

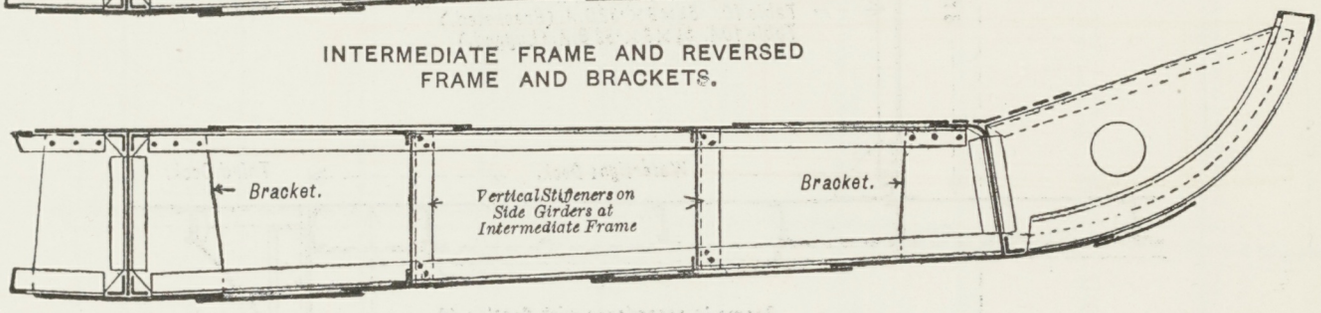
(Section 16 and Tables 8 & 9.)

FLOORS AT ALTERNATE FRAMES.

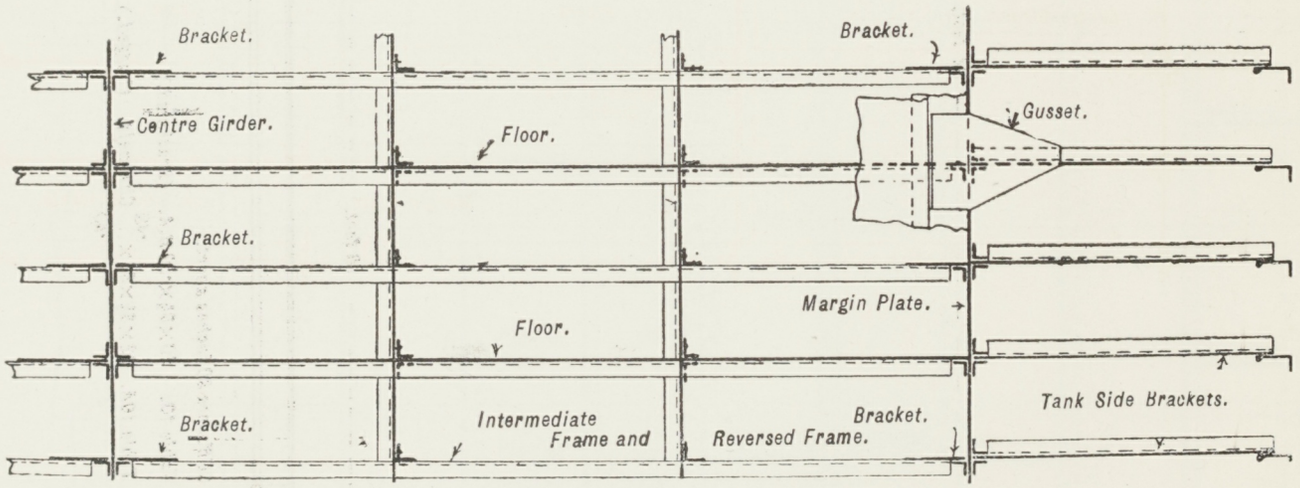
Above 28 feet and not exceeding 36 feet Breadth of Inner Bottom.
,, 34 ,, ,, ,, ,, 50 ,, ,, ,, Vessel.



INTERMEDIATE FRAME AND REVERSED FRAME AND BRACKETS.



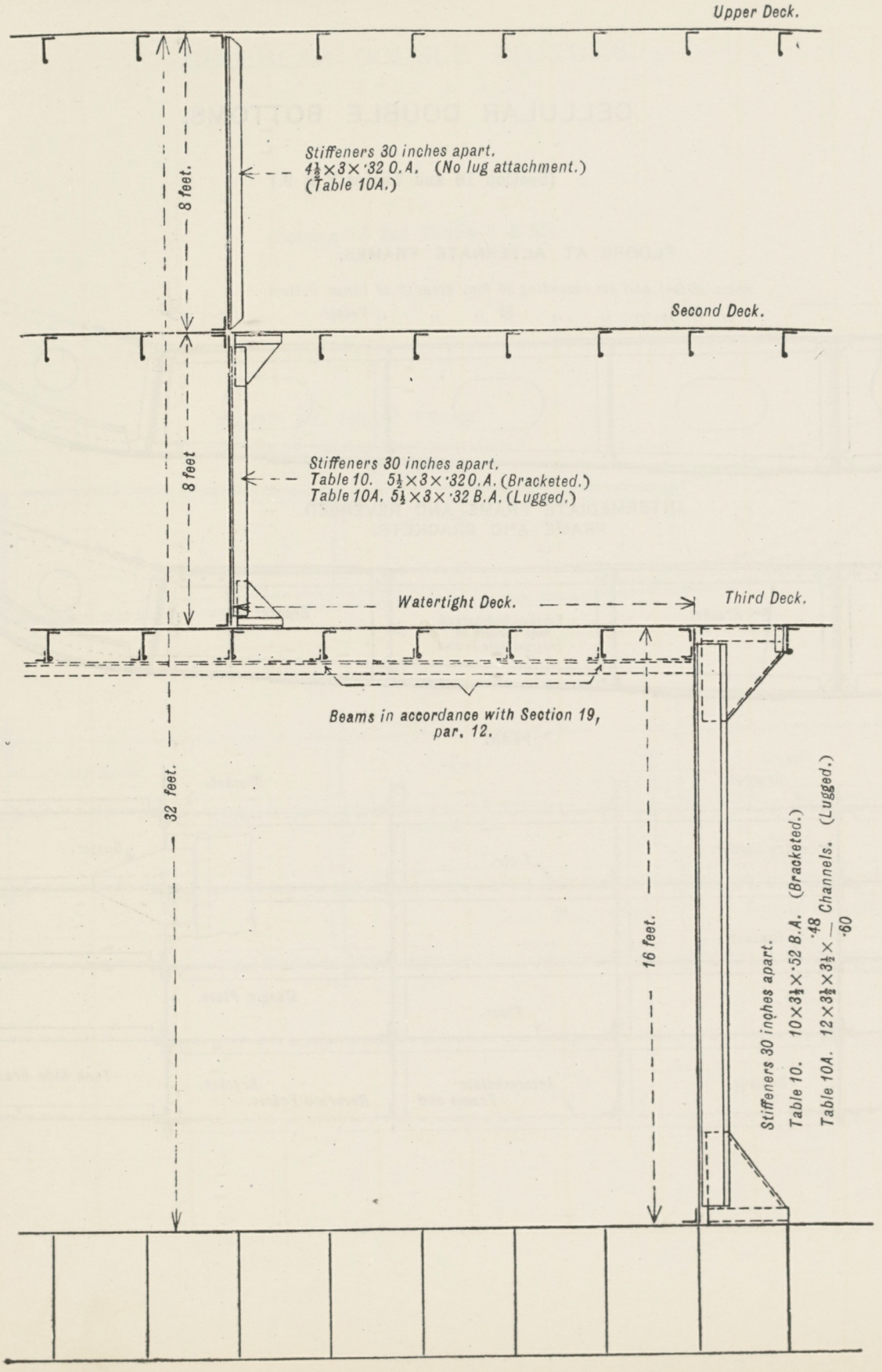
PLAN.



WATERTIGHT BULKHEAD.

STIFFENERS IN HOLD AND 'TWEEN DECKS.

(Section 19.)



WATERTIGHT BULKHEADS.

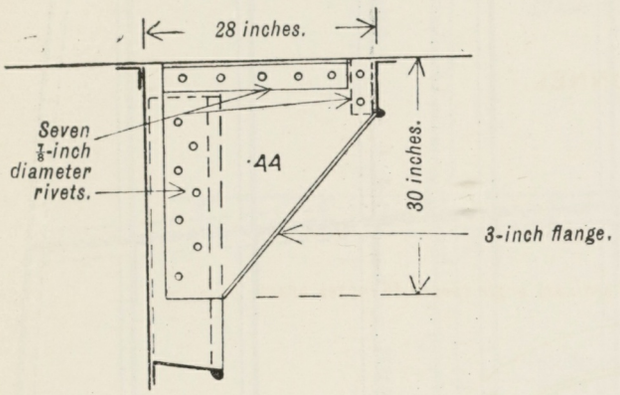
(Section 19.)

ARRANGEMENT OF BULKHEAD PLATING WITH STIFFENERS SPACED 30 INCHES APART.

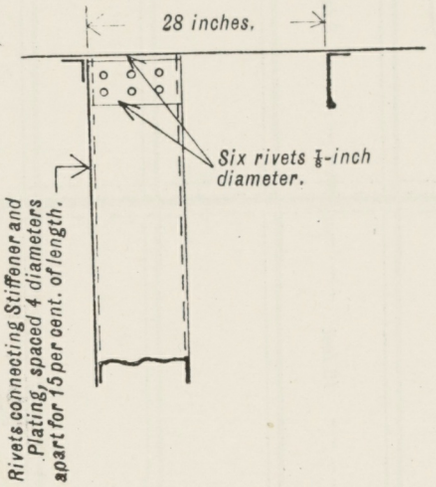
WATERTIGHT BULKHEADS.

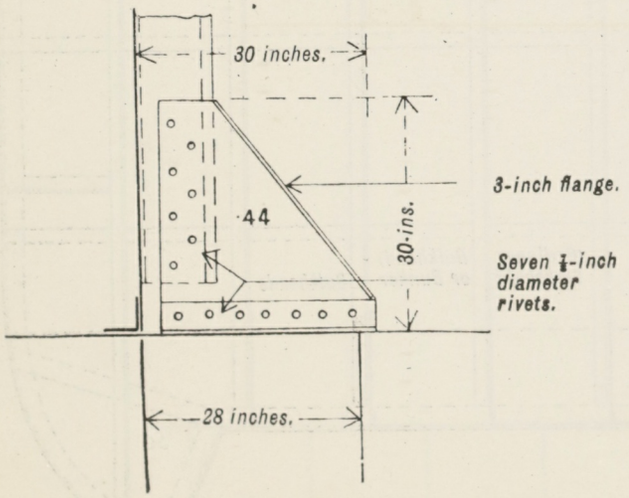
(See Section 19 and Table 10B.)

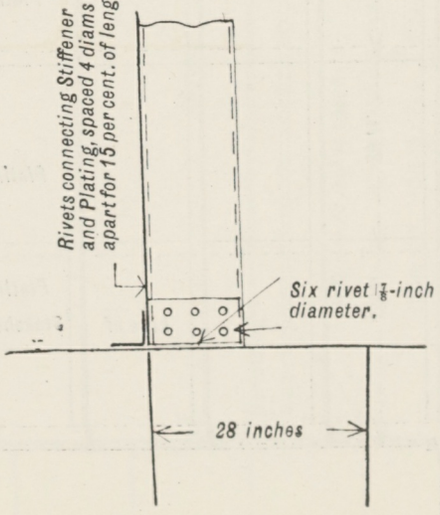
BRACKET CONNECTION AT TOP AND BOTTOM OF A 10-INCH BULB ANGLE STIFFENER IN HOLD.



LUG CONNECTION AT TOP AND BOTTOM OF A 12 × 3½ × 3½ CHANNEL STIFFENER IN HOLD.



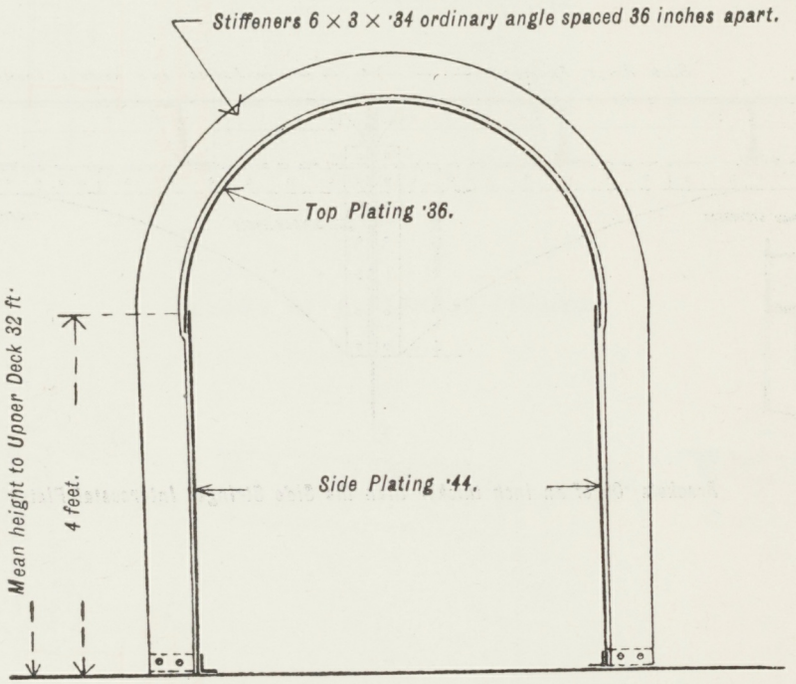




WATERTIGHT BULKHEADS.

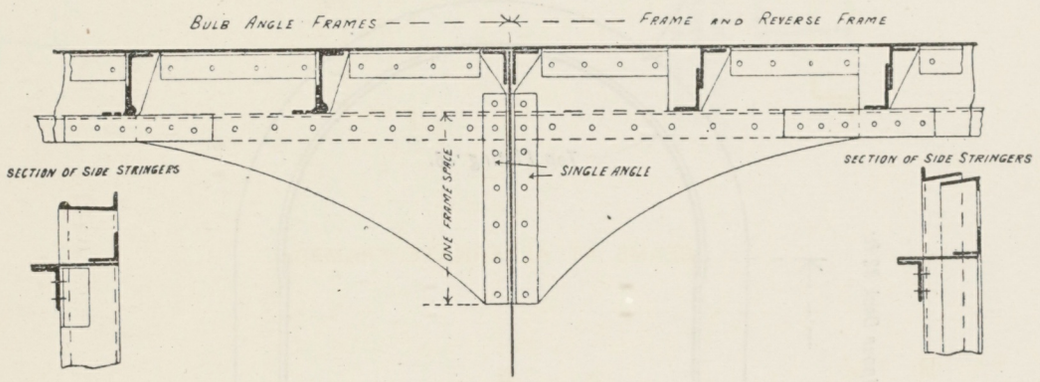
(Section 19 and Table 10D.)

SHAFT TUNNEL.



SIDE STRINGER BRACKETS AT WATERTIGHT BULKHEADS.

(Section 15, pars. 3 & 4 and Section 19, par. 10.)

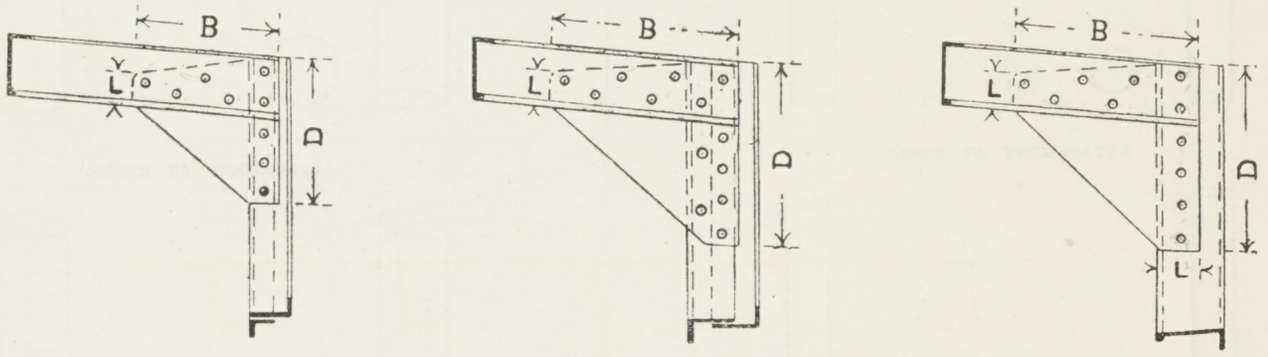


Brackets ·06 of an inch thicker than the Side Stringer Intercostal Plate.

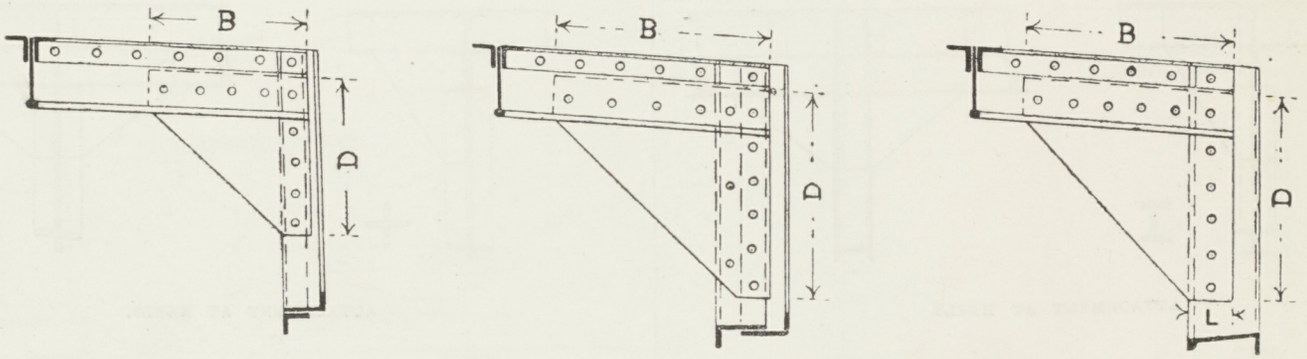
BRACKET PLATE BEAM KNEES.

(Section 20 and Tables 11 & 12.)

BEAMS AT EVERY FRAME.



BEAMS AT ALTERNATE FRAMES.



D = Depth. B = Breadth. L = Lap, which is not to be less than six times the diameter of rivets.

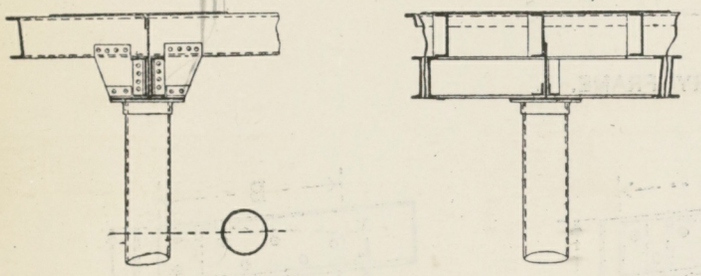
NOTE :—Where the depth of the bulb plate below the angles is not sufficient to allow of an overlap of six times the diameter of the rivets, the knee plates are to be extended to the upper edge of the beams.

SOME METHODS OF ATTACHING THE WIDELY SPACED PILLARS AT HEADS AND HEELS.

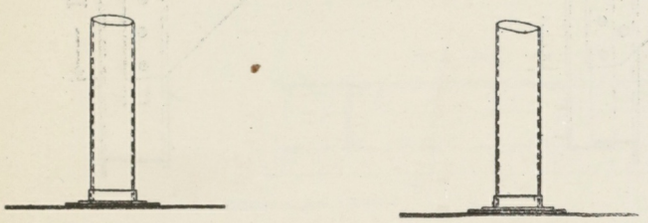
(Section 22 and Table 15.)

ATTACHMENT AT HEAD OF A TUBULAR PILLAR.

ELEVATION.

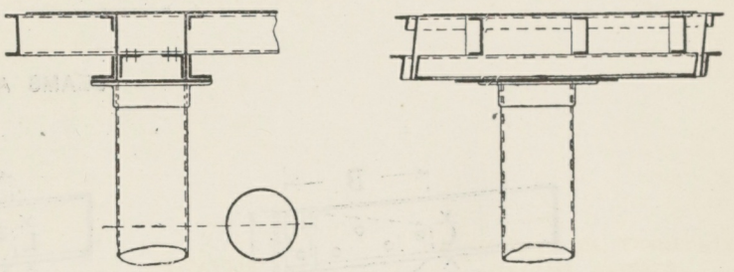


ATTACHMENT AT HEELS.

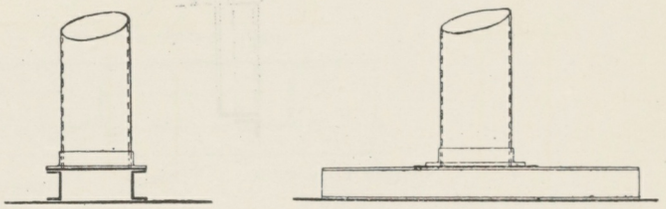


ATTACHMENT AT HEAD OF A TUBULAR PILLAR.

ELEVATION.

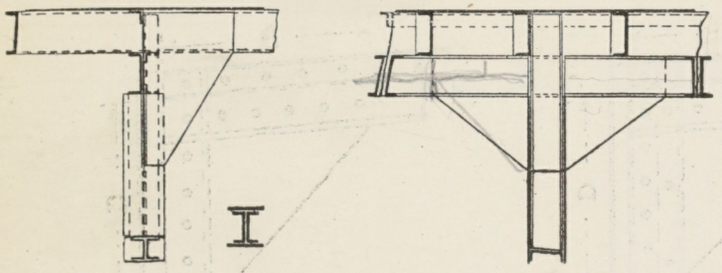


ATTACHMENT AT HEELS.

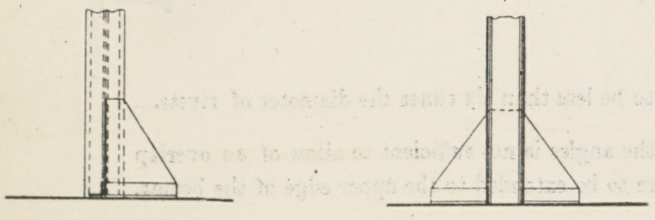


ATTACHMENT AT HEAD OF A PILLAR FORMED OF DOUBLE CHANNELS AND FACE PLATES.

ELEVATION.

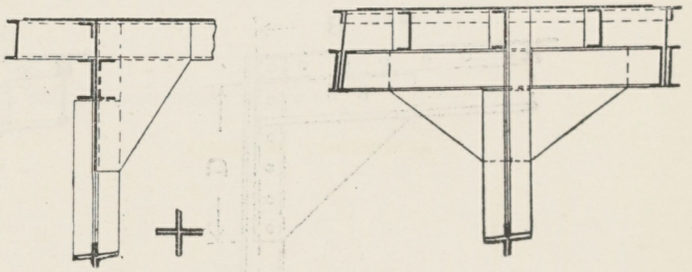


ATTACHMENT AT HEELS.

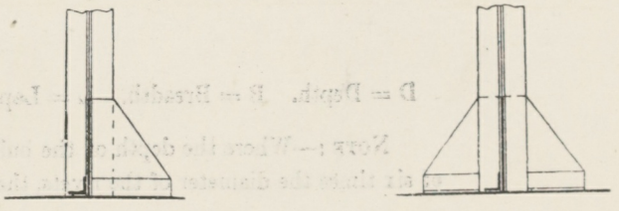


ATTACHMENT AT HEAD OF A PILLAR FORMED OF FOUR ANGLES.

ELEVATION.



ATTACHMENT AT HEELS.

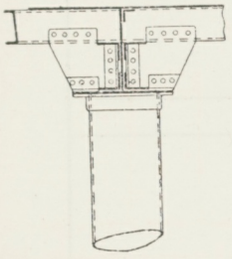


1. Pillars and girders of other form will be admitted provided the same are of equivalent strength to those given in Tables 15 and 16.
2. Arrangements are to be made at the various decks in order to secure an efficient distribution of the support afforded by the pillars. Arrangements are also to be made at the heels of the pillars to secure an effective distribution of the load carried over the adjacent structure. As far as possible the pillars are to be stepped on the tank top at the intersection of a floor and of an intercostal ; where this cannot be done partial floors and intercostals are to be fitted. No manholes are to be cut in the floors and intercostals in way of the heels of the pillars.
3. For Scantlings of widely spaced Pillars, and Girders at heads of same, *see* Tables 15 and 16.

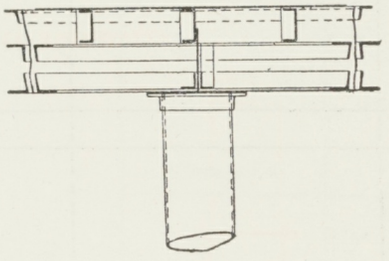
SOME METHODS OF ATTACHING THE WIDELY SPACED PILLARS AT HEADS AND HEELS.

(Section 22 and Table 15.)

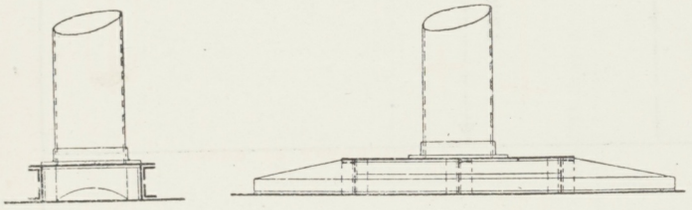
ATTACHMENT AT HEAD OF A TUBULAR PILLAR.



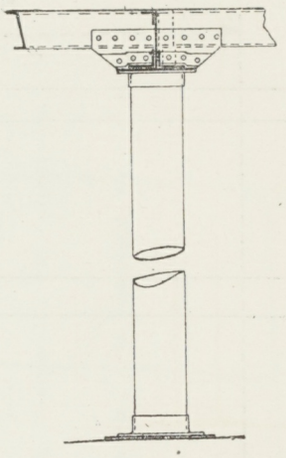
ELEVATION.



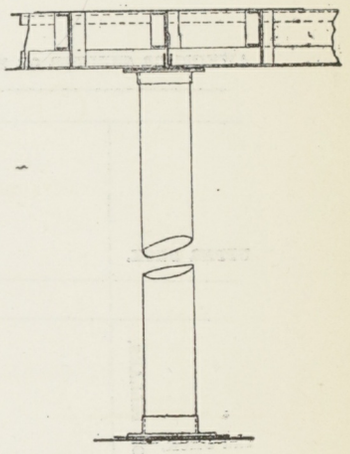
ATTACHMENT AT HEELS.



ATTACHMENT AT HEAD OF A TUBULAR PILLAR.

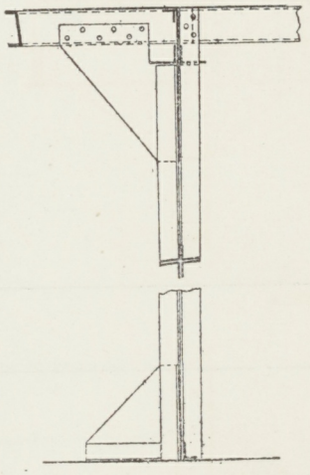


ELEVATION.

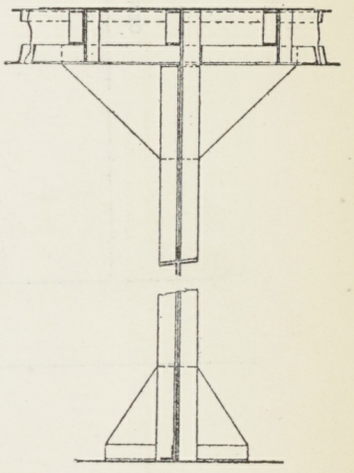


ATTACHMENT AT HEELS.

ATTACHMENT AT HEAD OF A PILLAR FORMED OF FOUR ANGLES.



ELEVATION.

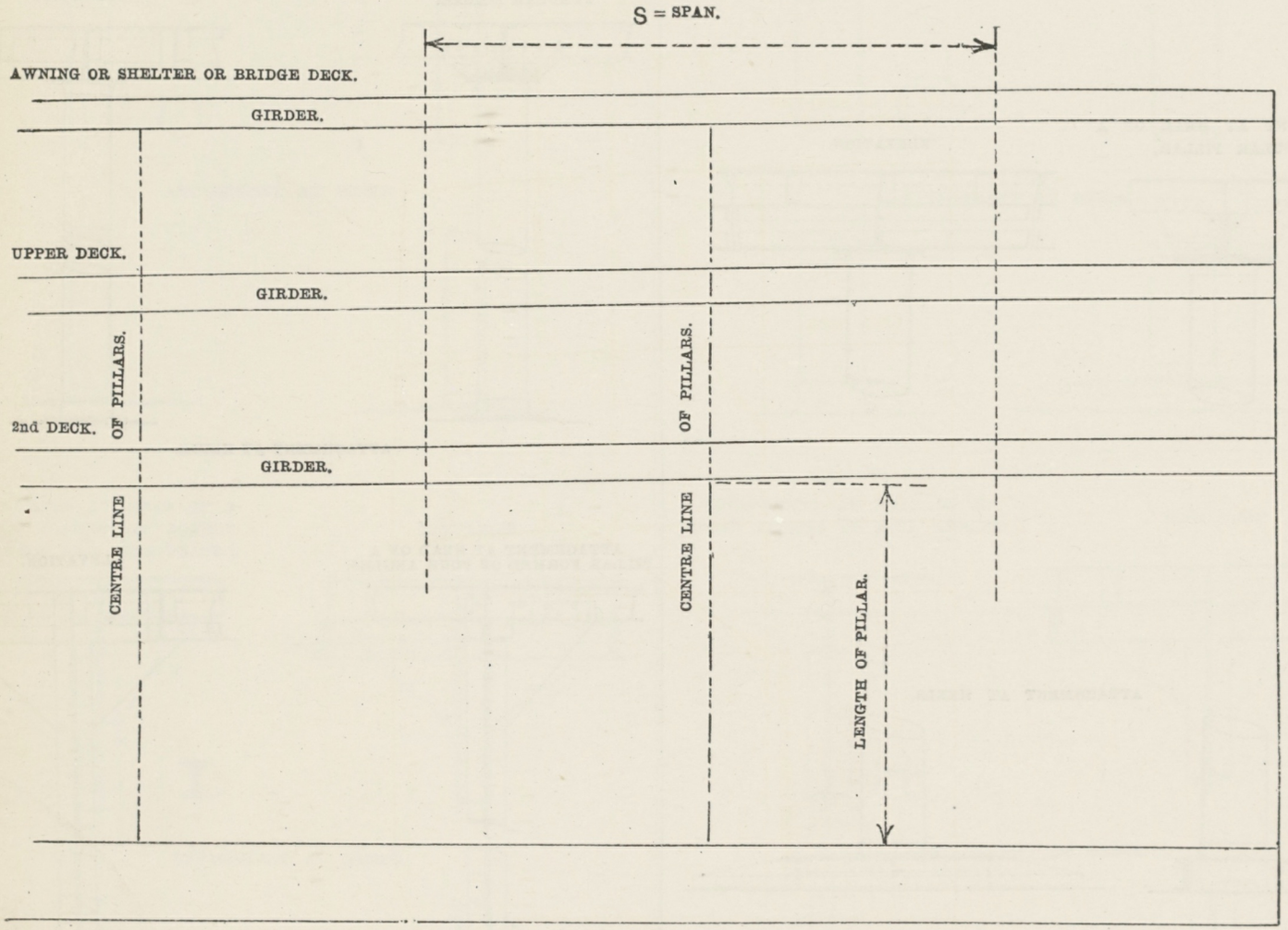


ATTACHMENT AT HEELS

WIDELY SPACED PILLARS.

METHOD OF ESTIMATING NUMBERS FOR REGULATING SIZES OF PILLARS.

(Section 22 and Table 15.)

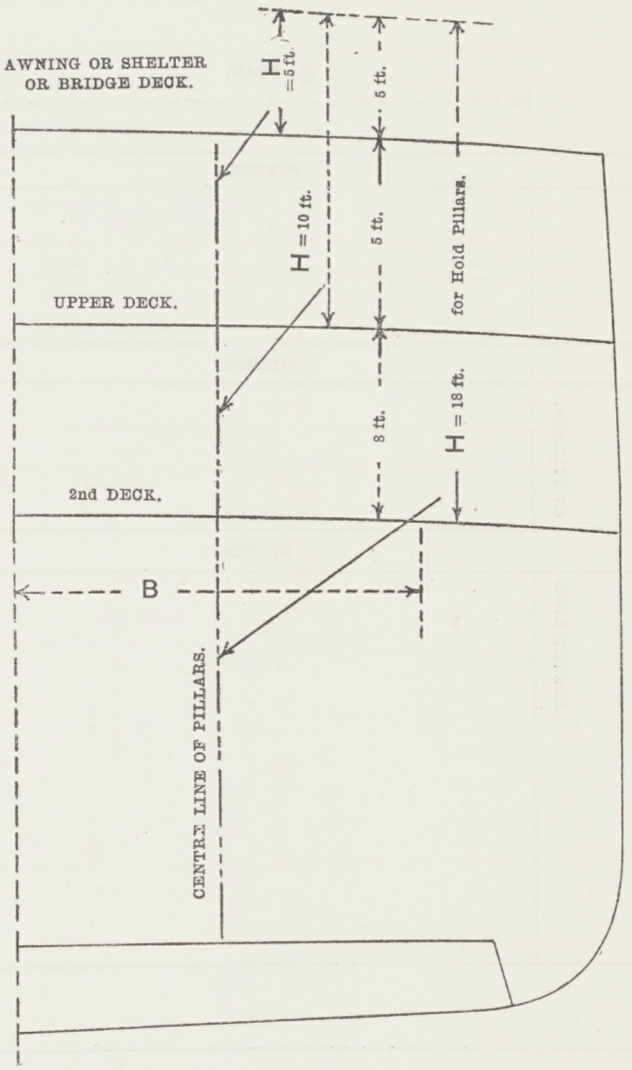


$$\text{Number for Pillars} = \frac{S \times B \times H}{100}$$

WIDELY SPACED PILLARS.

METHOD OF ESTIMATING NUMBERS FOR REGULATING SIZES OF PILLARS.

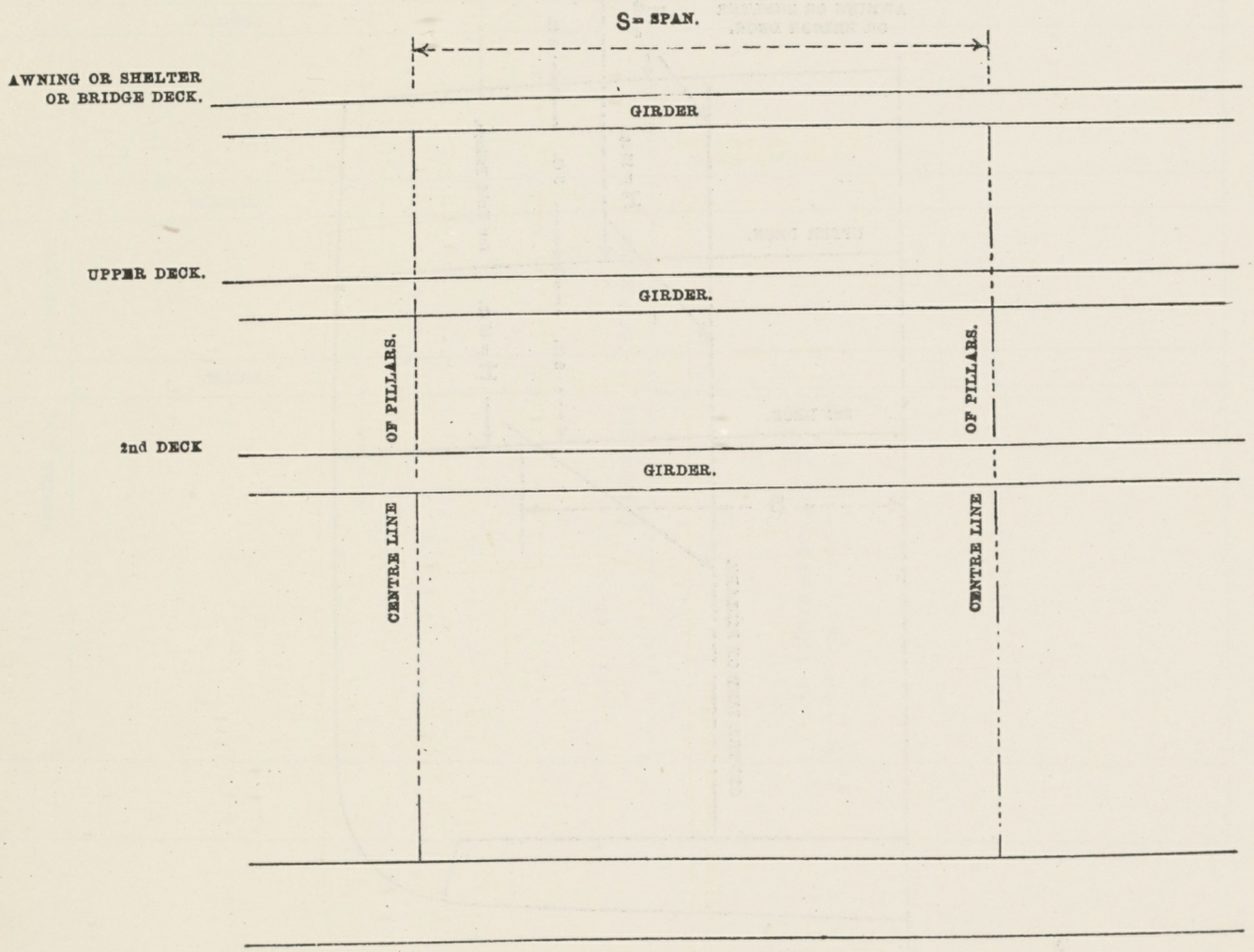
(Section 22 and Table 15.)



GIRDERS AT HEADS OF WIDELY SPACED PILLARS.

METHOD OF ESTIMATING NUMBERS FOR REGULATING SCANTLINGS OF GIRDERS.

(Section 22 and Table 16.)

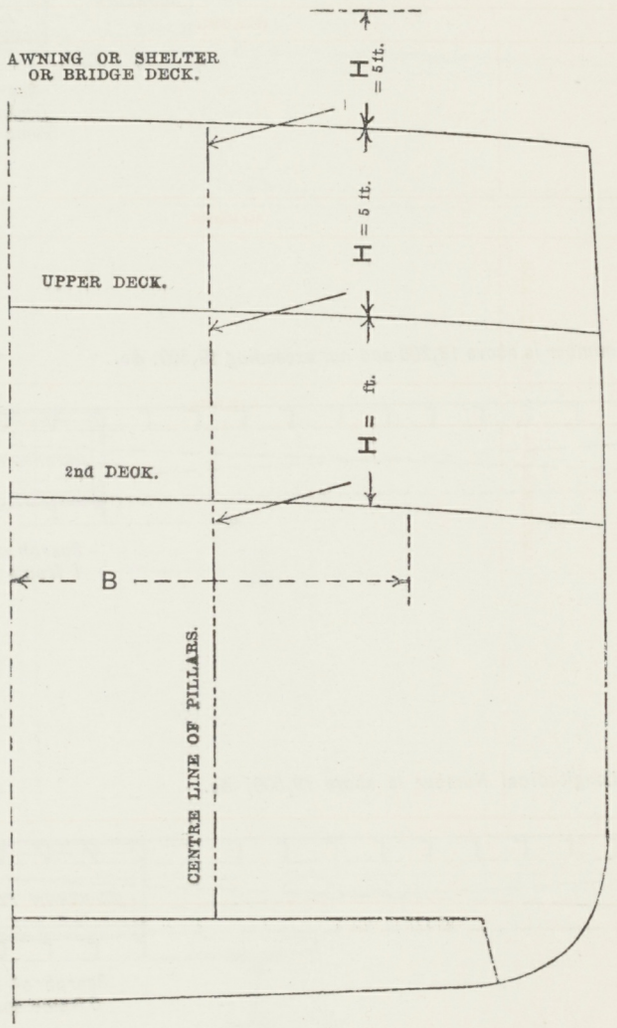


$$\text{Number for Girders} = \frac{S^2 \times B \times H}{100}$$

GIRDERS AT HEADS OF WIDELY SPACED PILLARS.

METHOD OF ESTIMATING NUMBERS FOR REGULATING SCANTLINGS OF GIRDERS.

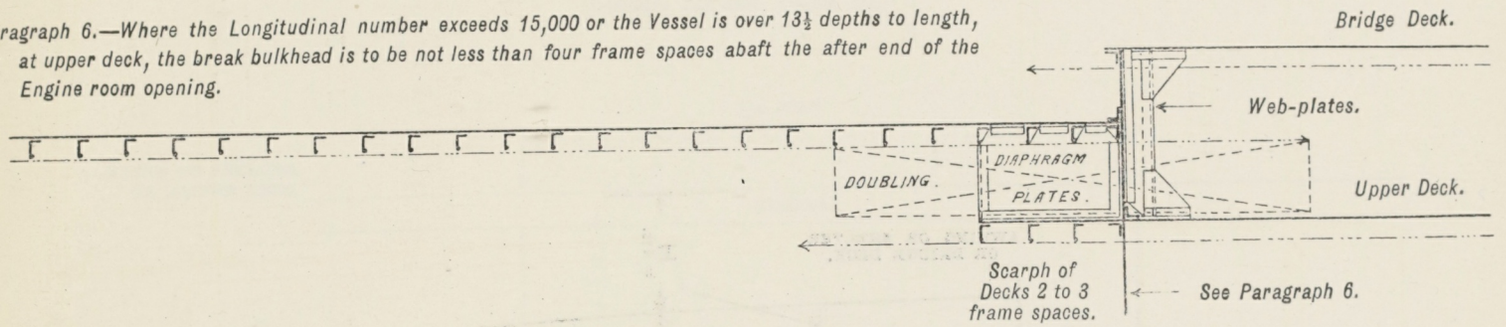
(Section 22 and Table 16.)



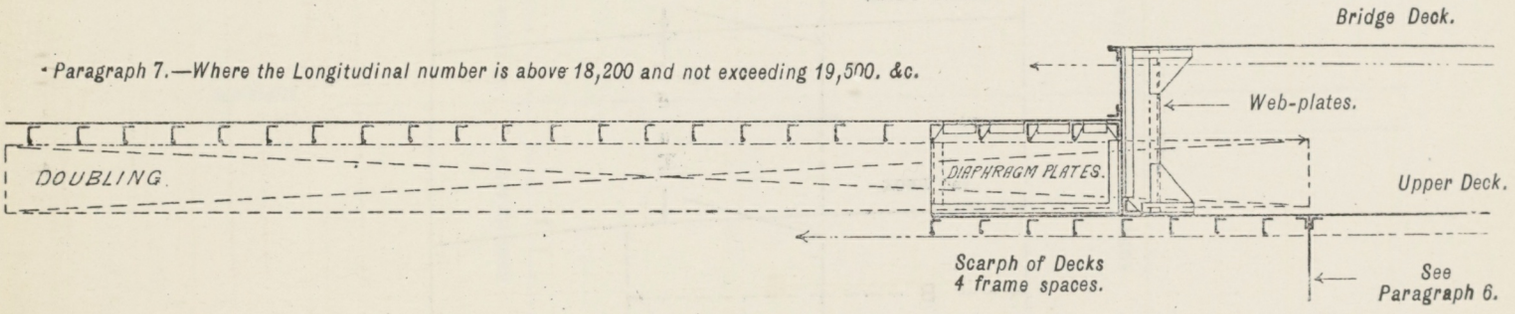
STRENGTHENING AT BREAK OF RAISED QUARTER DECK.

(Section 46, paragraphs 4, 5, 6 and 7.)

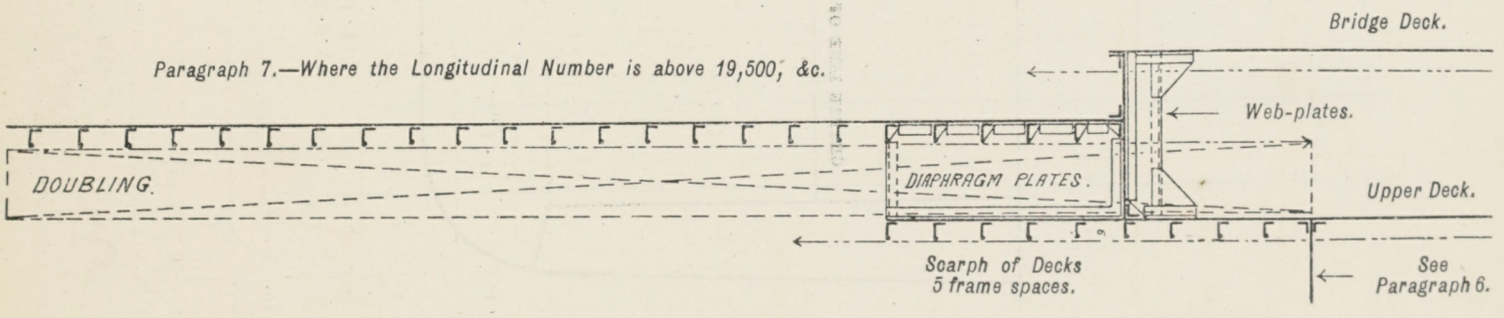
Paragraph 6.—Where the Longitudinal number exceeds 15,000 or the Vessel is over 13½ depths to length, at upper deck, the break bulkhead is to be not less than four frame spaces abaft the after end of the Engine room opening.



Paragraph 7.—Where the Longitudinal number is above 18,200 and not exceeding 19,500. &c.



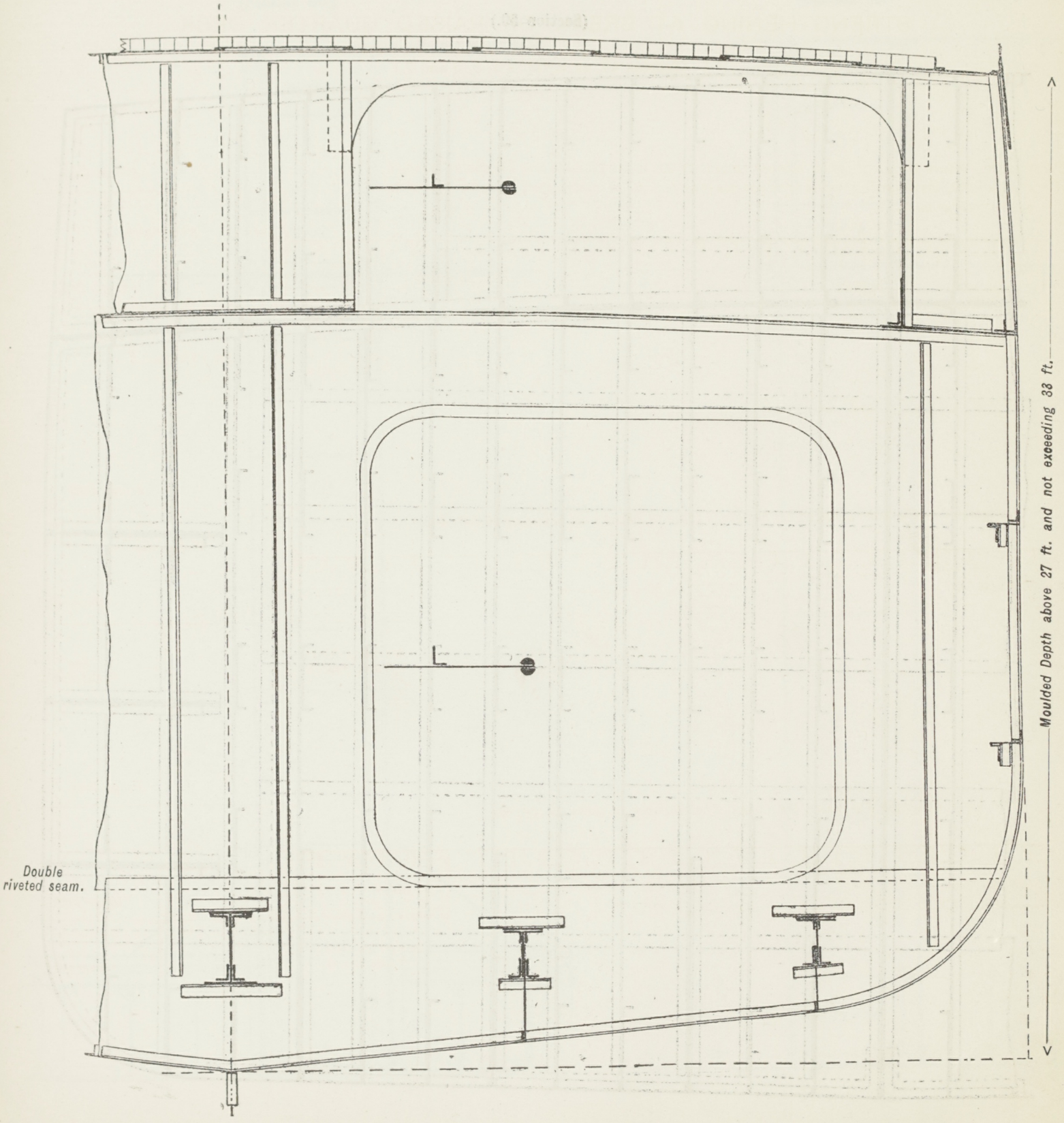
Paragraph 7.—Where the Longitudinal Number is above 19,500, &c.



PARTIAL BULKHEAD IN SAILING VESSELS.

WHERE THE MOULDED DEPTH IS ABOVE 27 FEET AND NOT EXCEEDING 33 FEET.

(Section 47, paragraph 4.)

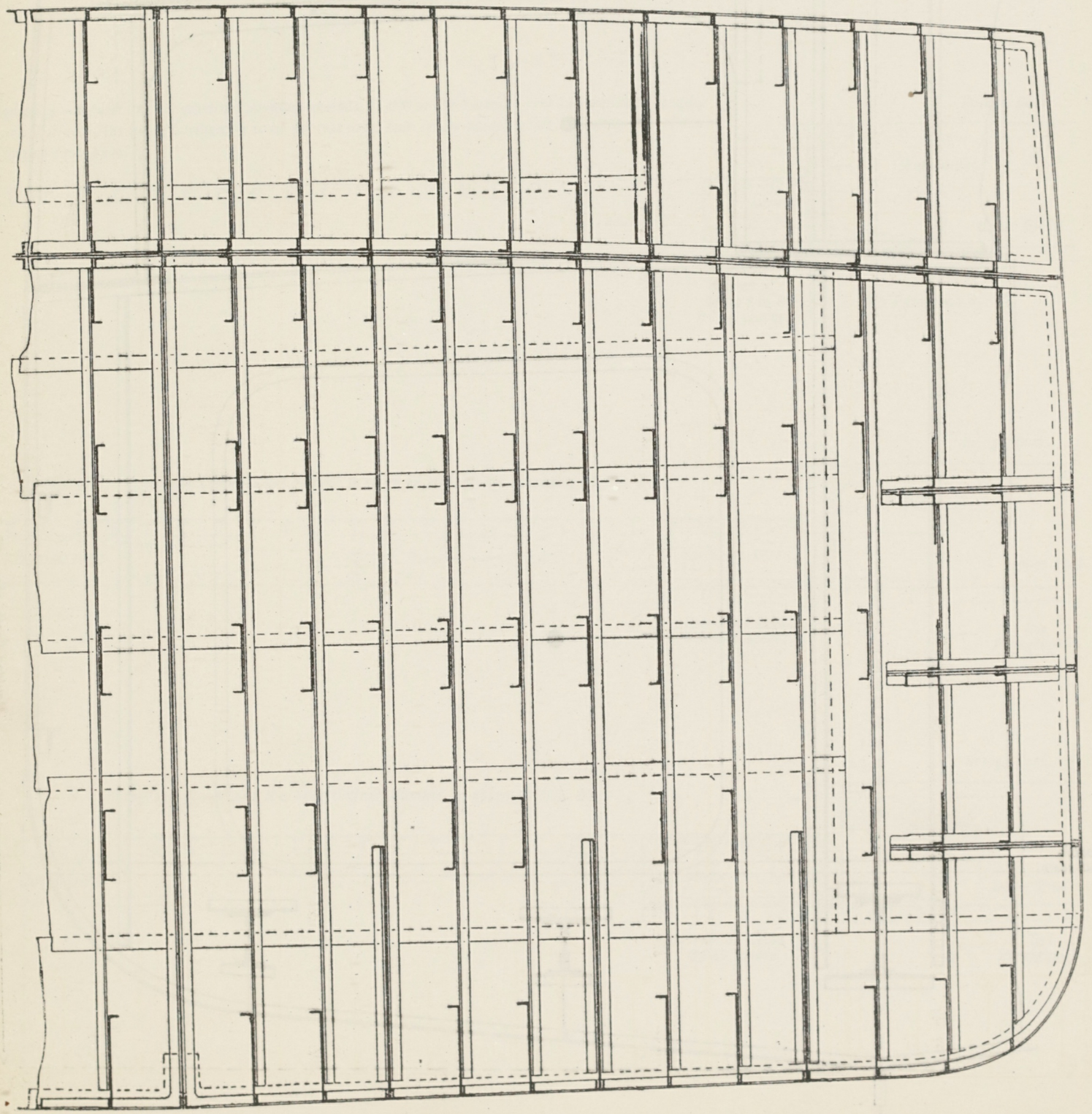


VESSELS INTENDED TO CARRY OIL IN BULK.

COFFERDAM BULKHEADS.

ARRANGEMENT OF STIFFENING INSIDE COFFERDAMS.

(Section 59.)

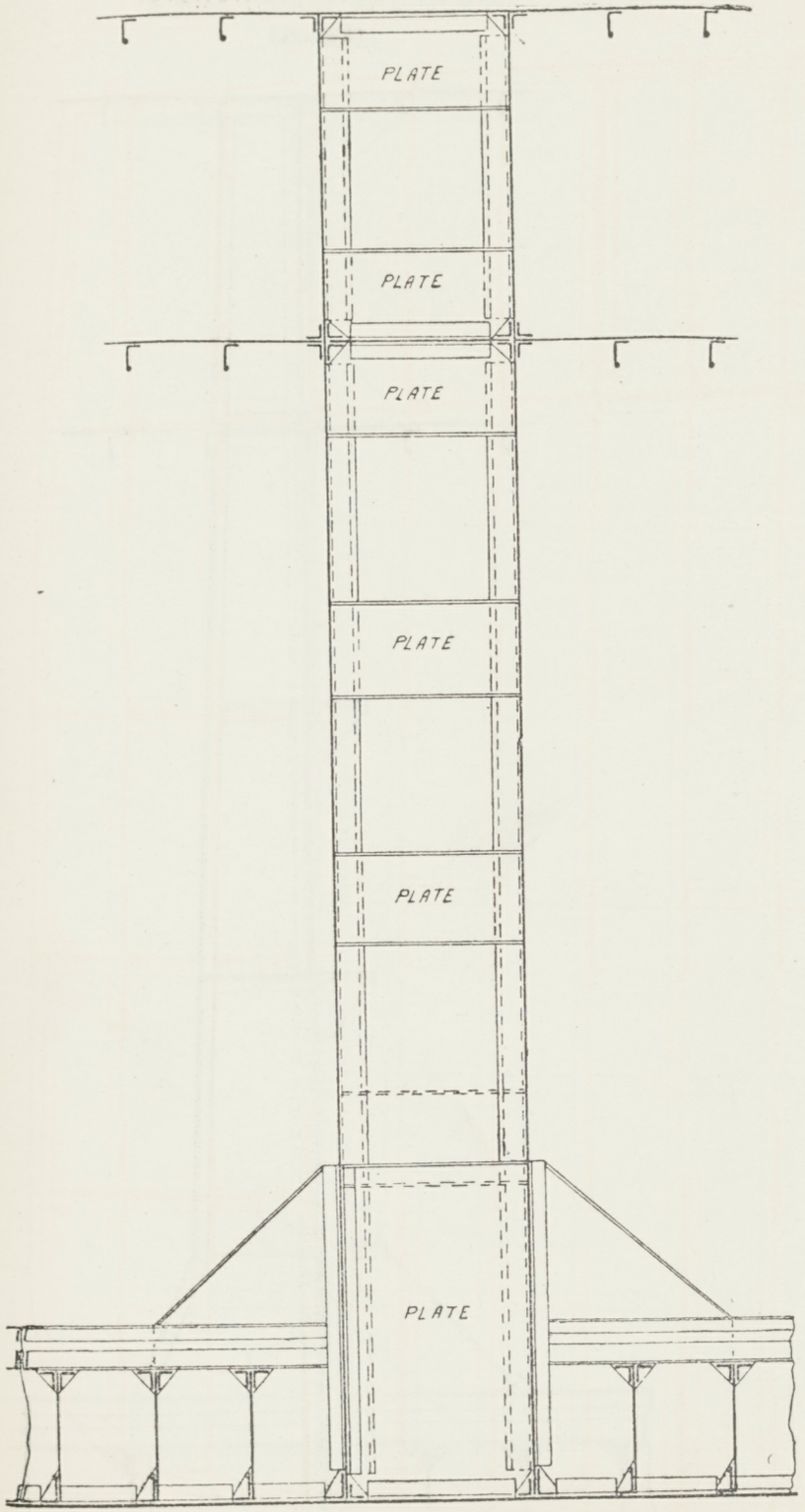


VESSELS INTENDED TO CARRY OIL IN BULK.

COFFERDAM BULKHEADS.

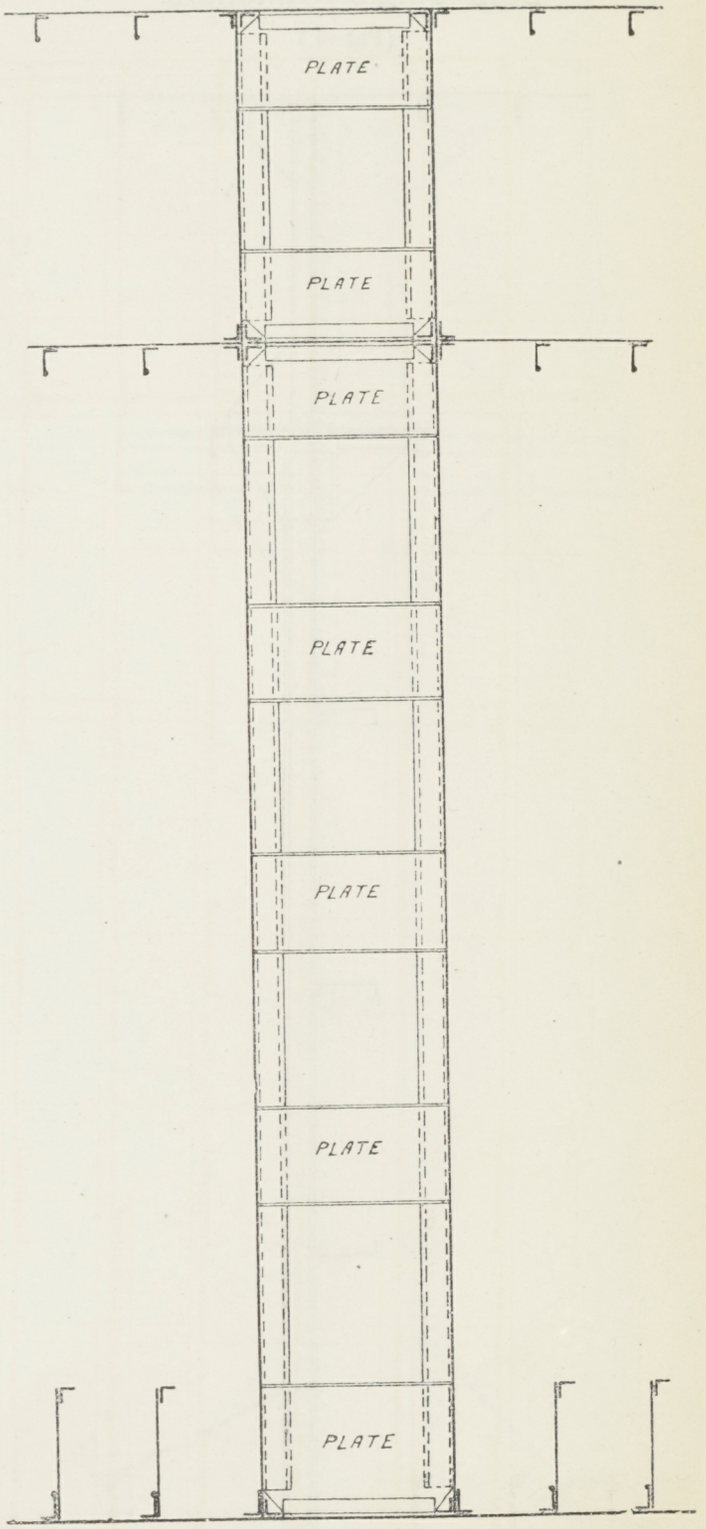
ARRANGEMENT OF STIFFENING INSIDE COFFERDAMS IN WAY OF KEELSONS.

(Section 59.)



ARRANGEMENT OF STIFFENING INSIDE COFFERDAMS CLEAR OF KEELSONS.

(Section 59.)



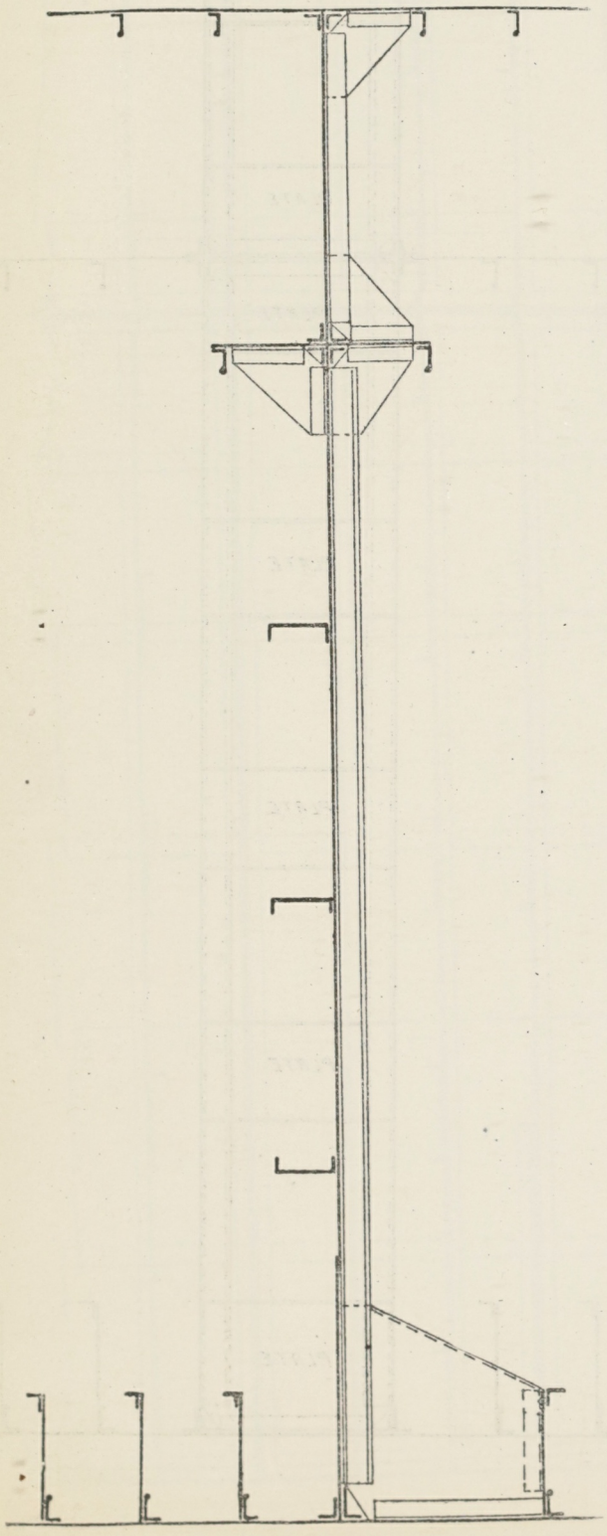
VESSELS INTENDED TO CARRY OIL IN BULK.

TRANSVERSE BULKHEAD.

(Section 58 and Table 35.)

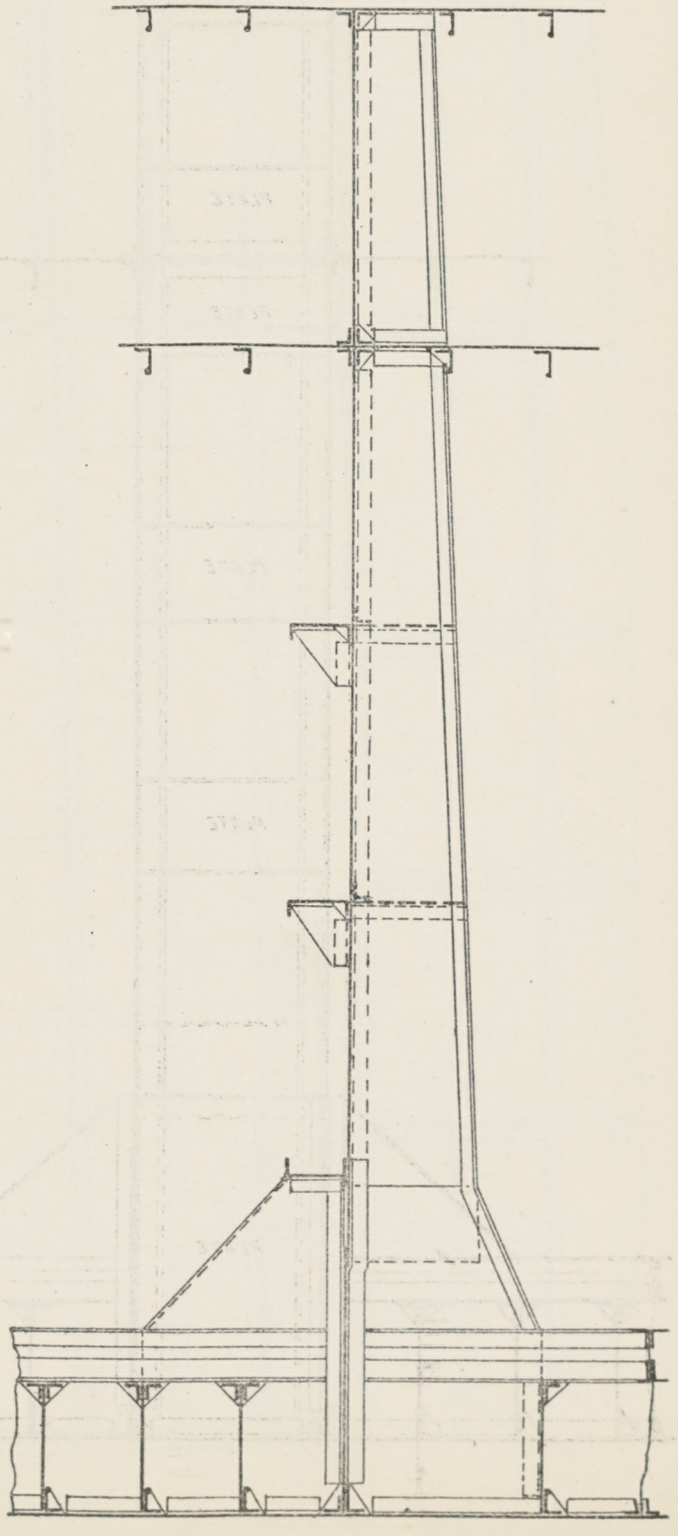
Bulb Angle Stiffeners.

(Par. 4.)



Web Plate Stiffeners.

(Par. 8.)



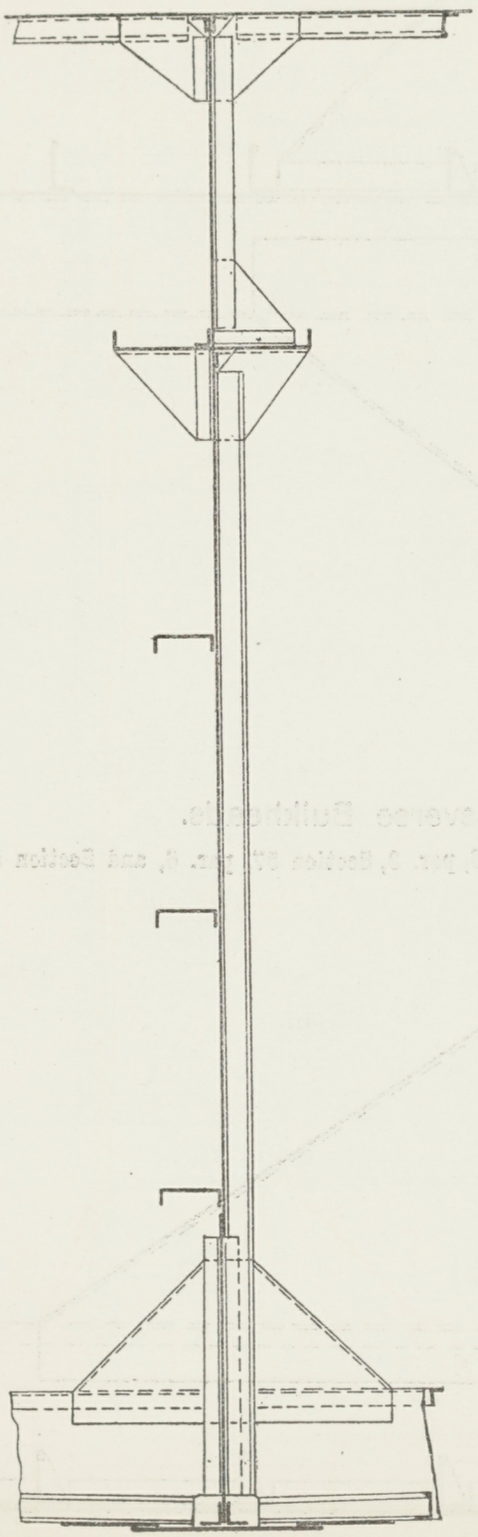
VESSELS INTENDED TO CARRY OIL IN BULK.

MIDDLE LINE BULKHEAD.

(Section 60 and Table 35.)

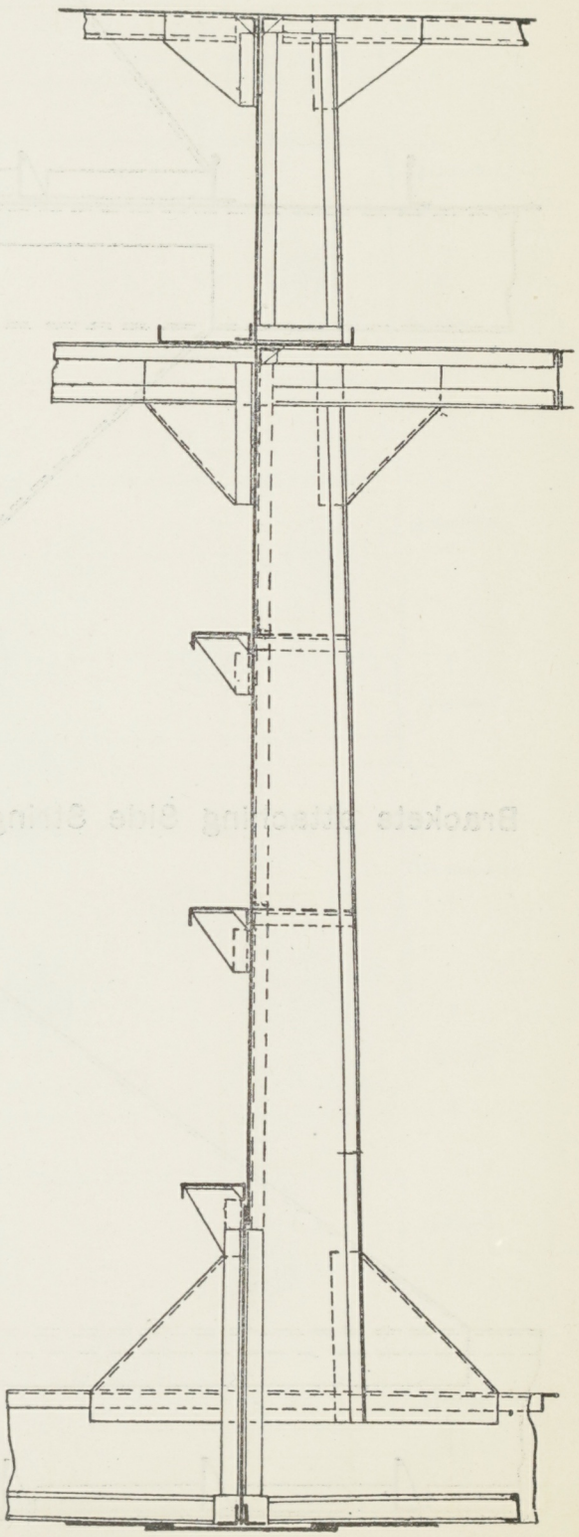
Bulb Angle Stiffeners.

(Par. 4.)



Web Plate Stiffeners.

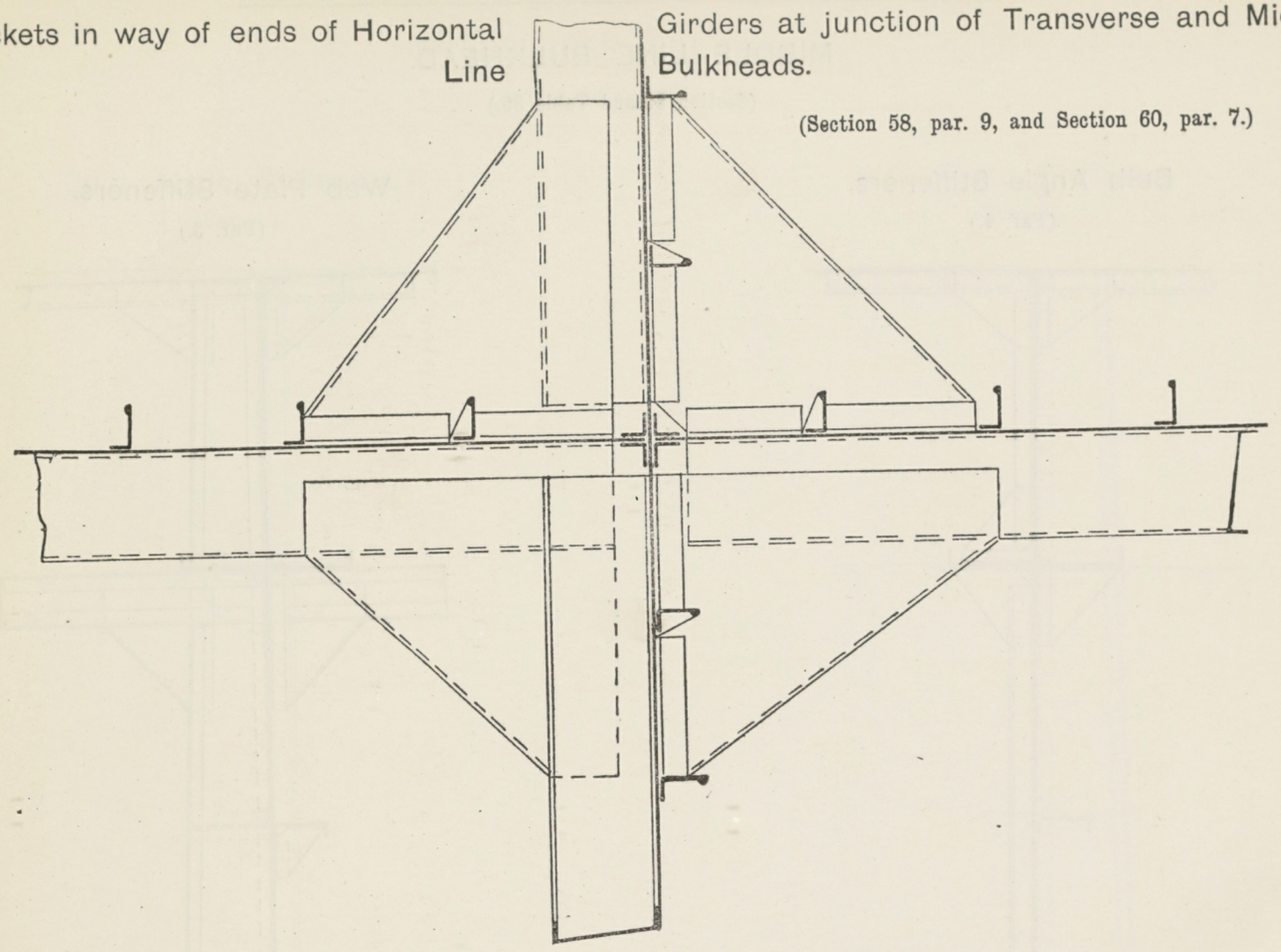
(Par. 5.)



VESSELS INTENDED TO CARRY OIL IN BULK.

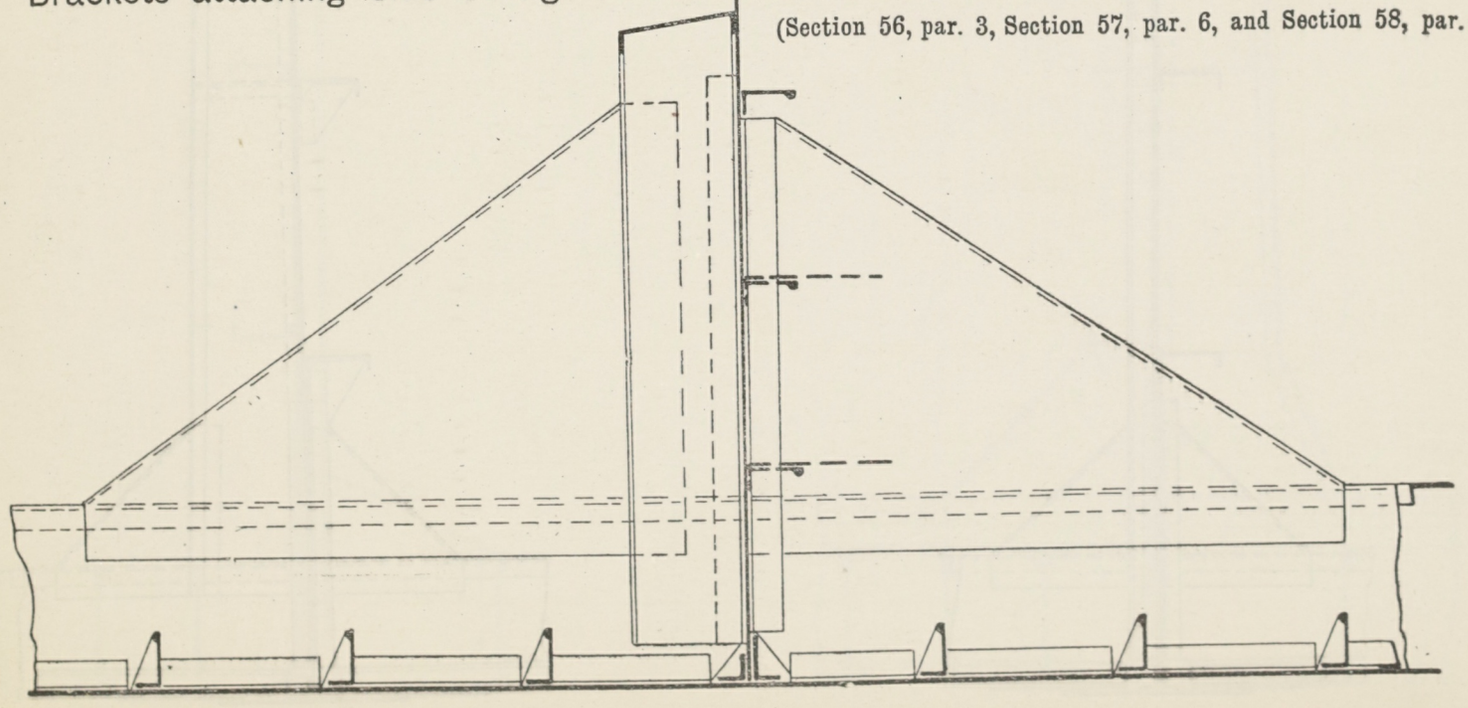
Brackets in way of ends of Horizontal Line Girders at junction of Transverse and Middle Bulkheads.

(Section 58, par. 9, and Section 60, par. 7.)



Brackets attaching Side Stringers to Transverse Bulkheads.

(Section 56, par. 3, Section 57, par. 6, and Section 58, par. 9.)



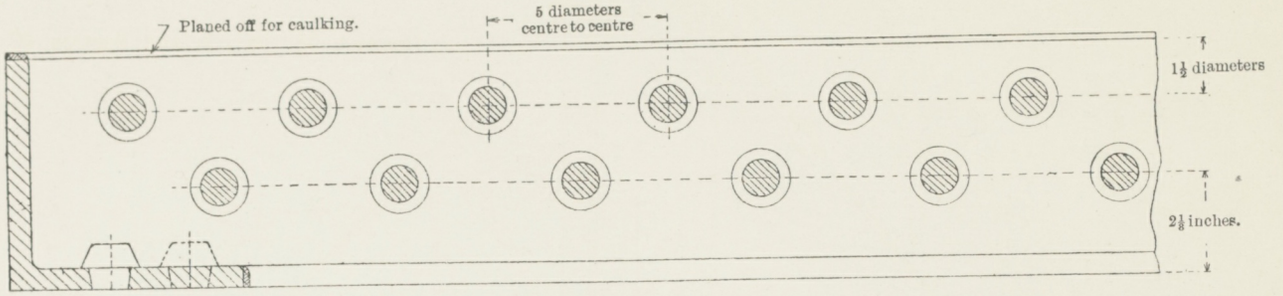
VESSELS INTENDED TO CARRY OIL IN BULK.

ARRANGEMENT OF REELED RIVETING IN FLAT KEEL ANGLES, SINGLE BULKHEAD FRAMES, &c.

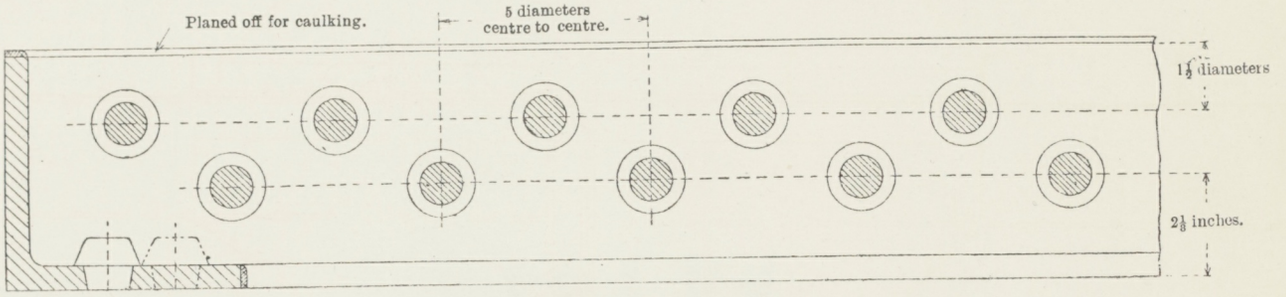
ANGLES 5″ × 5″.

Rivets spaced 5 diameters centre to centre.

$\frac{3}{4}$″ Rivets.

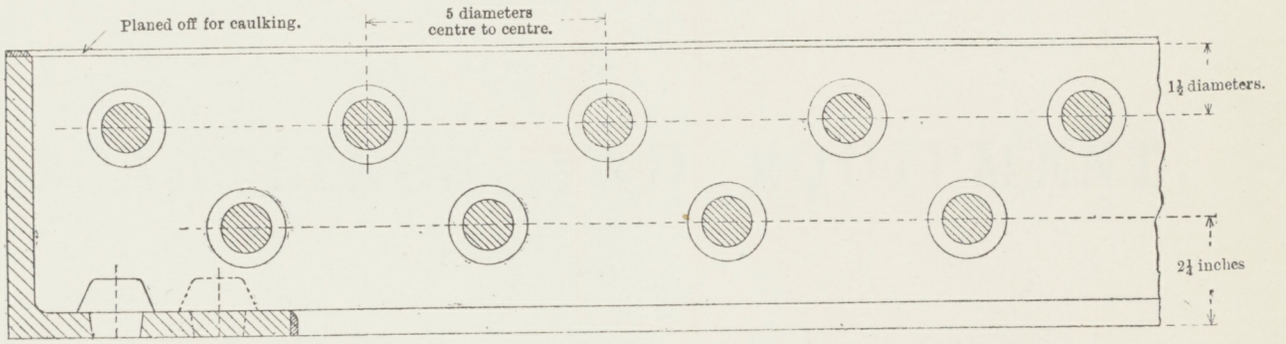


$\frac{7}{8}$″ Rivets.

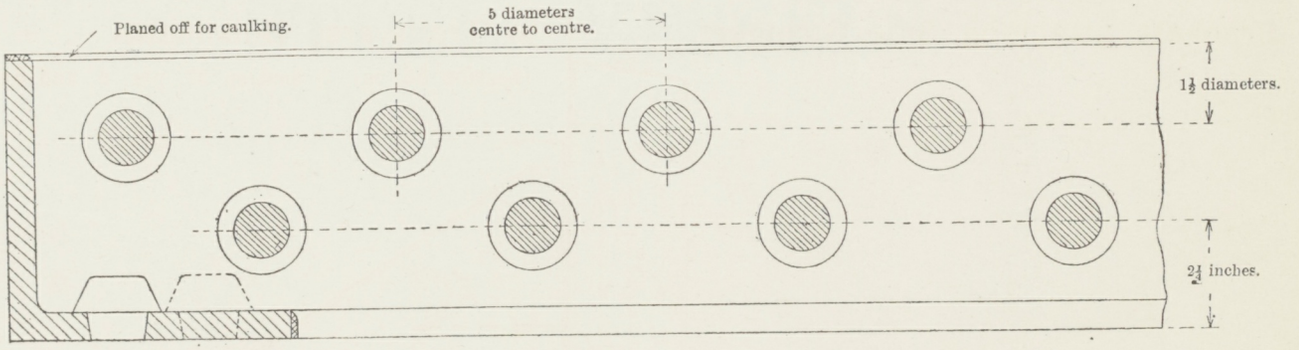


ANGLES 6″ × 6″.

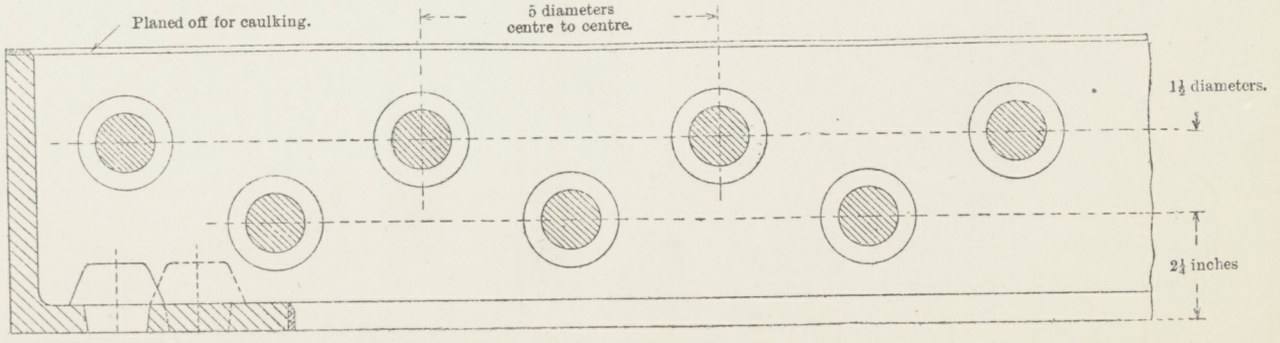
1″ Rivets.



1⅛″ Rivets.



1¼″ Rivets.



TABLES

OF

SCANTLINGS AND EQUIPMENT

FOR

STEEL VESSELS.

KEELS, STEMS, and STERNPOSTS. TABLE 1.

LONGITUDINAL NUMBER. L × (B + D).		KEELS.	STEMS.	STERN-POSTS WITHOUT APER-TURES.	STERN FRAMES WITH APERTURES.	
					Propeller Post.	Rudder Post.
Above	not exceeding	Inches.	Inches.	Inches.	Inches.	Inches.
2100 and	2700	6 × 1 1/8	5 1/4 × 1 1/8	5 1/4 × 1 1/8	5 1/4 × 2 1/4	5 × 2 1/4
2700 „	3350	6 1/4 × 1 1/4	5 1/2 × 1 1/4	5 1/2 × 1 1/4	5 1/2 × 2 1/2	5 1/4 × 2 1/2
3350 „	4000	6 3/4 × 1 1/4	5 3/4 × 1 1/4	5 3/4 × 1 1/4	5 3/4 × 2 3/4	5 1/2 × 2 3/4
4000 „	4650	6 3/4 × 1 3/8	5 3/4 × 1 3/8	5 3/4 × 1 3/8	5 3/4 × 3	5 1/2 × 3
4650 „	5300	7 × 1 1/2	6 × 1 1/2	6 × 1 1/2	6 × 3 1/4	5 3/4 × 3 1/4
5300 „	5950	7 × 1 5/8	6 × 1 5/8	6 × 1 5/8	6 × 3 1/2	5 3/4 × 3 1/2
5950 „	6600	7 1/4 × 1 3/4	6 1/4 × 1 5/8	6 1/4 × 1 3/4	6 1/4 × 3 3/4	5 3/4 × 3 3/4
6600 „	7250	7 1/4 × 1 7/8	6 1/4 × 1 3/4	6 1/4 × 1 7/8	6 1/4 × 4	5 3/4 × 4
7250 „	7900	7 1/4 × 1 7/8	6 1/4 × 1 3/4	6 1/4 × 1 7/8	6 1/4 × 4 1/4	5 3/4 × 4 1/4
7900 „	8550	7 1/4 × 2	6 1/4 × 1 7/8	6 1/4 × 2	6 1/4 × 4 1/2	5 3/4 × 4 1/2
8550 „	9200	7 1/2 × 2 1/8	6 1/2 × 1 7/8	6 1/2 × 2 1/8	6 1/2 × 4 1/2	6 × 4 1/2
9200 „	9850	7 1/2 × 2 1/4	6 1/2 × 2	6 1/2 × 2 1/4	6 1/2 × 4 3/4	6 × 4 3/4
9850 „	10500	7 3/4 × 2 1/4	6 3/4 × 2	6 3/4 × 2 1/4	6 3/4 × 4 3/4	6 × 4 3/4
10500 „	11150	7 3/4 × 2 3/8	6 3/4 × 2 1/8	6 3/4 × 2 3/8	6 3/4 × 5	6 × 5
11150 „	11800	8 × 2 3/8	7 × 2 1/8	7 × 2 3/8	7 × 5	6 1/4 × 5
11800 „	12500	8 1/4 × 2 3/8	7 1/4 × 2 1/8	7 1/4 × 2 3/8	7 1/4 × 5	6 1/2 × 5
12500 „	13300	8 1/4 × 2 1/2	7 1/4 × 2 1/4	7 1/4 × 2 1/2	7 1/4 × 5 1/4	6 1/2 × 5 1/4
13300 „	14200	8 1/2 × 2 1/2	7 1/2 × 2 1/4	7 1/2 × 2 1/2	7 1/2 × 5 1/4	6 3/4 × 5 1/4
14200 „	15200	8 1/2 × 2 5/8	7 1/2 × 2 3/8	7 1/2 × 2 5/8	7 1/2 × 5 1/2	6 3/4 × 5 1/2
15200 „	16300	9 × 2 5/8	8 × 2 3/8	8 × 2 5/8	8 × 5 1/2	7 × 5 1/2
16300 and	17500	9 1/2 × 2 5/8	8 1/2 × 2 3/8	8 1/2 × 2 5/8	8 1/2 × 5 1/2	7 1/2 × 5 1/2
17500 „	18900	10 × 2 5/8	9 × 2 3/8	9 × 2 5/8	9 × 5 1/2	8 × 5 1/2
18900 „	20500	10 × 2 3/4	9 × 2 1/2	9 × 2 3/4	9 × 6	8 × 6
20500 „	22300	10 1/2 × 2 3/4	9 1/2 × 2 1/2	9 1/2 × 2 3/4	9 1/2 × 6	8 1/2 × 6
22300 „	24300	10 1/2 × 2 3/4	9 1/2 × 2 1/2	9 1/2 × 2 3/4	9 1/2 × 6 1/2	8 1/2 × 6 1/2
24300 „	26500	11 × 2 3/4	10 × 2 1/2	10 × 2 3/4	10 × 6 1/2	9 × 6 1/2
26500 „	28900	11 × 2 7/8	10 × 2 5/8	10 × 2 7/8	10 × 7	9 × 7
28900 „	31500	11 1/2 × 2 7/8	10 × 2 3/4	10 × 3	10 × 7 1/2	9 × 7 1/2
31500 „	34300	11 1/2 × 3	10 1/2 × 2 3/4	10 1/2 × 3	10 1/2 × 7 1/2	9 × 7 1/2
34300 „	37300	12 × 3	10 1/2 × 2 3/4	10 1/2 × 3 1/8	10 1/2 × 8	9 × 8
37300 „	40500	—	10 1/2 × 2 7/8	10 1/2 × 3 1/4	10 1/2 × 8 1/2	9 × 8 1/2
40500 „	43900	—	11 × 2 7/8	11 × 3 1/4	11 × 8 1/2	9 1/2 × 8 1/2
43900 „	47500	—	11 × 3	11 × 3 3/8	11 × 9	9 1/2 × 9
47500 „	51300	—	11 × 3 1/8	11 × 3 1/2	11 × 9 1/2	9 1/2 × 9 1/2
51300 „	55300	—	11 1/2 × 3 1/8	11 1/2 × 3 1/2	11 1/2 × 9 1/2	10 × 9 1/2
55300 „	59700	—	11 1/2 × 3 1/8	11 1/2 × 3 5/8	11 1/2 × 10	10 × 10
59700 „	64500	—	11 1/2 × 3 1/4	11 1/2 × 3 3/4	12 × 10	10 1/2 × 10
64500 „	69700	—	12 × 3 1/4	12 × 3 3/4	12 × 10 1/2	10 1/2 × 10 1/2
69700 „	75300	—	12 × 3 3/8	12 × 3 7/8	12 1/2 × 10 1/2	11 × 10 1/2
75300 „	81000	—	12 × 3 1/2	12 × 4	12 1/2 × 11	11 × 11

The sectional area of the sole piece of stern frame is to be increased 15 per cent. beyond the sectional area of the propeller post.

The thickness of the sides of the boss of the propeller post is to be not less than three-fifths that required by the Table for the propeller post.

In high powered single screw vessels the dimensions of the stern frame will require to be increased to the satisfaction of the Committee.

LLOYD'S REGISTER OF SHIPPING, LONDON.—*11th May, 1911.*

FRAMES with SINGLE REVERSED FRAMES.

TABLE 2.

(See Continuation.)

TRANSVERSE NUMBER. B + D	FRAME SPACING.		FRAMING IN PEAKS.	DEPTH (d) AT MIDDLE OF LENGTH FROM TOP OF FLOORS AT CENTRE IN WAY OF SINGLE BOTTOMS, AND FROM TOP OF MARGIN PLATE IN WAY OF DOUBLE BOTTOMS, TO TOP OF LOWEST TIER OF BEAMS AT SIDE. *See* SKETCH ON PAGE 21.					
				Feet. Above 7 and not exceeding 8	Feet. Above 8 and not exceeding 9	Feet. Above 9 and not exceeding 10	Feet. Above 10 and not exceeding 11	Feet. Above 11 and not exceeding 12	Feet. Above 12 and not exceeding 13
				< ONE SIDE STRINGER. >					
Feet. Above 23 and not exceeding 25	inches. 20	Frames Reversed frames Depth of framing	inches. $2\frac{1}{4} \times 2\frac{1}{4} \times \cdot22$ $2\frac{1}{4} \times 2\frac{1}{4} \times \cdot22$ $2\frac{1}{4}$	inches. $2\frac{1}{4} \times 2\frac{1}{4} \times \cdot22$ $2\frac{1}{4} \times 2\frac{1}{4} \times \cdot22$ $2\frac{1}{4}$	inches. $2\frac{1}{2} \times 2\frac{1}{2} \times \cdot22$ $2\frac{1}{4} \times 2\frac{1}{4} \times \cdot22$ $2\frac{1}{2}$	inches. $2\frac{1}{2} \times 2\frac{1}{2} \times \cdot24$ $2\frac{1}{4} \times 2\frac{1}{4} \times \cdot22$ $2\frac{1}{2}$	inches. $2\frac{1}{2} \times 2\frac{1}{2} \times \cdot24$ $2\frac{1}{4} \times 2\frac{1}{4} \times \cdot24$ $2\frac{1}{2}$	inches.	inches.
25 „ 27	20	Frames Reversed frames Depth of framing	$2\frac{1}{2} \times 2\frac{1}{2} \times \cdot22$ $2\frac{1}{4} \times 2\frac{1}{4} \times \cdot22$ $2\frac{1}{2}$	$2\frac{1}{2} \times 2\frac{1}{2} \times \cdot22$ $2\frac{1}{4} \times 2\frac{1}{4} \times \cdot22$ $2\frac{1}{2}$	$2\frac{1}{2} \times 2\frac{1}{2} \times \cdot24$ $2\frac{1}{4} \times 2\frac{1}{4} \times \cdot22$ $2\frac{1}{2}$	$2\frac{1}{2} \times 2\frac{1}{2} \times \cdot24$ $2\frac{1}{4} \times 2\frac{1}{4} \times \cdot24$ $2\frac{1}{2}$	2 × $2\frac{1}{2} \times \cdot24$ $2\frac{1}{4} \times 2\frac{1}{4} \times \cdot24$ 3	3 × $2\frac{1}{2} \times \cdot24$ $2\frac{1}{2} \times 2\frac{1}{2} \times \cdot24$ 3	
27 „ 29	$20\frac{1}{2}$	Frames Reversed frames Depth of framing	$2\frac{1}{2} \times 2\frac{1}{2} \times \cdot24$ $2\frac{1}{4} \times 2\frac{1}{4} \times \cdot22$ $2\frac{1}{2}$	$2\frac{1}{2} \times 2\frac{1}{2} \times \cdot24$ $2\frac{1}{4} \times 2\frac{1}{4} \times \cdot22$ $2\frac{1}{2}$	$2\frac{1}{2} \times 2\frac{1}{2} \times \cdot24$ $2\frac{1}{4} \times 2\frac{1}{4} \times \cdot24$ $2\frac{1}{2}$	3 × $2\frac{1}{2} \times \cdot24$ $2\frac{1}{4} \times 2\frac{1}{4} \times \cdot24$ 3	3 × $2\frac{1}{2} \times \cdot24$ $2\frac{1}{2} \times 2\frac{1}{2} \times \cdot24$ 3	3 × $2\frac{1}{2} \times \cdot24$ $2\frac{1}{2} \times 2\frac{1}{2} \times \cdot24$ 3	3 × 3 × ·24 $2\frac{1}{2} \times 2\frac{1}{2} \times \cdot24$ 3
29 „ 31	$20\frac{1}{2}$	Frames Reversed frames Depth of framing	$2\frac{1}{2} \times 2\frac{1}{2} \times \cdot24$ $2\frac{1}{4} \times 2\frac{1}{4} \times \cdot24$ $2\frac{1}{2}$	$2\frac{1}{2} \times 2\frac{1}{2} \times \cdot24$ $2\frac{1}{4} \times 2\frac{1}{4} \times \cdot24$ $2\frac{1}{2}$	3 × $2\frac{1}{2} \times \cdot24$ $2\frac{1}{4} \times 2\frac{1}{4} \times \cdot24$ 3	3 × $2\frac{1}{2} \times \cdot24$ $2\frac{1}{2} \times 2\frac{1}{2} \times \cdot24$ 3	3 × $2\frac{1}{2} \times \cdot24$ $2\frac{1}{2} \times 2\frac{1}{2} \times \cdot24$ 3	3 × 3 × ·24 $2\frac{1}{2} \times 2\frac{1}{2} \times \cdot24$ 3	3 × 3 × ·26 $2\frac{1}{2} \times 2\frac{1}{2} \times \cdot26$ 3
31 „ 33	21	Frames Reversed frames Depth of framing	3 × $2\frac{1}{2} \times \cdot24$ $2\frac{1}{4} \times 2\frac{1}{4} \times \cdot24$ 3	3 × $2\frac{1}{2} \times \cdot24$ $2\frac{1}{4} \times 2\frac{1}{4} \times \cdot24$ 3	3 × $2\frac{1}{2} \times \cdot24$ $2\frac{1}{2} \times 2\frac{1}{2} \times \cdot24$ 3	3 × $2\frac{1}{2} \times \cdot24$ $2\frac{1}{2} \times 2\frac{1}{2} \times \cdot24$ 3	3 × 3 × ·24 $2\frac{1}{2} \times 2\frac{1}{2} \times \cdot24$ 3	3 × 3 × ·26 $2\frac{1}{2} \times 2\frac{1}{2} \times \cdot26$ 3	3 × 3 × ·28 $2\frac{1}{2} \times 2\frac{1}{2} \times \cdot28$ 3
33 „ 35	21	Frames Reversed frames Depth of framing	3 × $2\frac{1}{2} \times \cdot24$ $2\frac{1}{2} \times 2\frac{1}{2} \times \cdot24$ 3	3 × $2\frac{1}{2} \times \cdot24$ $2\frac{1}{2} \times 2\frac{1}{2} \times \cdot24$ 3	3 × $2\frac{1}{2} \times \cdot24$ $2\frac{1}{2} \times 2\frac{1}{2} \times \cdot24$ 3	3 × 3 × ·24 $2\frac{1}{2} \times 2\frac{1}{2} \times \cdot24$ 3	3 × 3 × ·26 $2\frac{1}{2} \times 2\frac{1}{2} \times \cdot26$ 3	3 × 3 × ·28 $2\frac{1}{2} \times 2\frac{1}{2} \times \cdot28$ 3	3 × 3 × ·28 $2\frac{1}{2} \times 2\frac{1}{2} \times \cdot28$ 3
35 „ 37	$21\frac{1}{2}$	Frames Reversed frames Depth of framing	3 × $2\frac{1}{2} \times \cdot26$ $2\frac{1}{2} \times 2\frac{1}{2} \times \cdot26$ 3	3 × $2\frac{1}{2} \times \cdot26$ $2\frac{1}{2} \times 2\frac{1}{2} \times \cdot26$ 3	3 × 3 × ·24 $2\frac{1}{2} \times 2\frac{1}{2} \times \cdot24$ 3	3 × 3 × ·26 $2\frac{1}{2} \times 2\frac{1}{2} \times \cdot26$ 3	3 × 3 × ·28 $2\frac{1}{2} \times 2\frac{1}{2} \times \cdot28$ 3	3 × 3 × ·28 $2\frac{1}{2} \times 2\frac{1}{2} \times \cdot28$ 3	3 × 3 × ·28 3 × $2\frac{1}{2} \times \cdot28$ 3
37 „ 39	$21\frac{1}{2}$	Frames Reversed frames Depth of framing	3 × 3 × ·26 $2\frac{1}{2} \times 2\frac{1}{2} \times \cdot26$ 3	3 × 3 × ·26 $2\frac{1}{2} \times 2\frac{1}{2} \times \cdot26$ 3	3 × 3 × ·26 $2\frac{1}{2} \times 2\frac{1}{2} \times \cdot26$ 3	3 × 3 × ·28 $2\frac{1}{2} \times 2\frac{1}{2} \times \cdot28$ 3	3 × 3 × ·28 $2\frac{1}{2} \times 2\frac{1}{2} \times \cdot28$ 3	3 × 3 × ·28 3 × $2\frac{1}{2} \times \cdot28$ 3	$3\frac{1}{2}$ × 3 × ·28 3 × $2\frac{1}{2} \times \cdot28$ $3\frac{1}{2}$
39 „ 42	22	Frames Reversed frames Depth of framing	3 × 3 × ·26 $2\frac{1}{2} \times 2\frac{1}{2} \times \cdot26$ 3	3 × 3 × ·26 $2\frac{1}{2} \times 2\frac{1}{2} \times \cdot26$ 3	3 × 3 × ·28 $2\frac{1}{2} \times 2\frac{1}{2} \times \cdot28$ 3	3 × 3 × ·28 $2\frac{1}{2} \times 2\frac{1}{2} \times \cdot28$ 3	3 × 3 × ·28 3 × $2\frac{1}{2} \times \cdot28$ 3	$3\frac{1}{2}$ × 3 × ·28 3 × $2\frac{1}{2} \times \cdot28$ $3\frac{1}{2}$	$3\frac{1}{2}$ × 3 × ·28 3 × 3 × ·28 $3\frac{1}{2}$
42 „ 45	22	Frames Reversed frames Depth of framing	3 × 3 × ·28 $2\frac{1}{2} \times 2\frac{1}{2} \times \cdot28$ 3	3 × 3 × ·28 $2\frac{1}{2} \times 2\frac{1}{2} \times \cdot28$ 3	3 × 3 × ·28 $2\frac{1}{2} \times 2\frac{1}{2} \times \cdot28$ 3	3 × 3 × ·28 3 × $2\frac{1}{2} \times \cdot28$ 3	$3\frac{1}{2}$ × 3 × ·28 3 × $2\frac{1}{2} \times \cdot28$ $3\frac{1}{2}$	$3\frac{1}{2}$ × 3 × ·28 3 × 3 × ·28 $3\frac{1}{2}$	4 × 3 × ·28 3 × 3 × ·28 4
45 „ 48	$22\frac{1}{2}$	Frames Reversed frames Depth of framing	$3\frac{1}{2}$ × 3 × ·30 $2\frac{1}{2} \times 2\frac{1}{2} \times \cdot30$ $3\frac{1}{2}$	$3\frac{1}{2}$ × 3 × ·30 $2\frac{1}{2} \times 2\frac{1}{2} \times \cdot30$ $3\frac{1}{2}$	$3\frac{1}{2}$ × 3 × ·30 $2\frac{1}{2} \times 2\frac{1}{2} \times \cdot30$ $3\frac{1}{2}$	$3\frac{1}{2}$ × 3 × ·30 3 × $2\frac{1}{2} \times \cdot30$ $3\frac{1}{2}$	$3\frac{1}{2}$ × 3 × ·30 3 × 3 × ·30 $3\frac{1}{2}$	4 × 3 × ·30 3 × 3 × ·30 4	4 × 3 × ·30 3 × 3 × ·30 4
48 „ 51	$22\frac{1}{2}$	Frames Reversed frames Depth of framing	$3\frac{1}{2}$ × 3 × ·30 3 × $2\frac{1}{2} \times \cdot30$ $3\frac{1}{2}$	$3\frac{1}{2}$ × 3 × ·30 3 × $2\frac{1}{2} \times \cdot30$ $3\frac{1}{2}$	$3\frac{1}{2}$ × 3 × ·30 3 × 3 × ·30 $3\frac{1}{2}$	4 × 3 × ·30 3 × 3 × ·30 4	4 × 3 × ·30 3 × 3 × ·30 4	4 × 3 × ·32 3 × 3 × ·32 4	4 × 3 × ·32 $3\frac{1}{2}$ × 3 × ·32 $4\frac{1}{2}$
51 „ 54	23	Frames Reversed frames Depth of framing	$3\frac{1}{2}$ × 3 × ·30 3 × 3 × ·30 $3\frac{1}{2}$	$3\frac{1}{2}$ × 3 × ·30 3 × 3 × ·30 $3\frac{1}{2}$	4 × 3 × ·30 3 × 3 × ·30 4	4 × 3 × ·30 $3\frac{1}{2}$ × 3 × ·30 $4\frac{1}{2}$	4 × 3 × ·32 $3\frac{1}{2}$ × 3 × ·32 $4\frac{1}{2}$	4 × 3 × ·32 $3\frac{1}{2}$ × 3 × ·32 $4\frac{1}{2}$	4 × 3 × ·32 4 × 3 × ·32 5
54 „ 57	23	Frames Reversed frames Depth of framing	4 × 3 × ·30 3 × 3 × ·30 4	4 × 3 × ·30 3 × 3 × ·30 4	4 × 3 × ·30 $3\frac{1}{2}$ × 3 × ·30 $4\frac{1}{2}$	4 × 3 × ·32 $3\frac{1}{2}$ × 3 × ·32 $4\frac{1}{2}$	4 × 3 × ·32 4 × 3 × ·32 5	4 × 3 × ·34 4 × 3 × ·34 5	4 × 3 × ·34 $4\frac{1}{2}$ × 3 × ·34 $5\frac{1}{2}$
57 „ 60	$23\frac{1}{2}$	Frames Reversed frames Depth of framing	$4\frac{1}{2}$ × 3 × ·30 3 × 3 × ·30 $4\frac{1}{2}$	$4\frac{1}{2}$ × 3 × ·30 3 × 3 × ·30 $4\frac{1}{2}$	$4\frac{1}{2}$ × 3 × ·32 3 × 3 × ·32 $4\frac{1}{2}$	$4\frac{1}{2}$ × 3 × ·32 $3\frac{1}{2}$ × 3 × ·32 5	$4\frac{1}{2}$ × 3 × ·34 $3\frac{1}{2}$ × 3 × ·34 5	$4\frac{1}{2}$ × 3 × ·34 4 × 3 × ·34 $5\frac{1}{2}$	$4\frac{1}{2}$ × 3 × ·36 4 × 3 × ·36 $5\frac{1}{2}$

FRAMES with SINGLE REVERSED FRAMES.

TABLE 2.

(See Continuation.)

TRANSVERSE NUMBER. B + D	FRAME SPACING.		DEPTH (d) AT MIDDLE OF LENGTH FROM TOP OF FLOORS AT CENTRE IN WAY OF SINGLE BOTTOMS, AND FROM TOP OF MARGIN PLATE IN WAY OF DOUBLE BOTTOMS, TO TOP OF LOWEST TIER OF BEAMS AT SIDE. *See* SKETCH ON PAGE 21.						
			Feet. Above 13 not exceeding 14	Feet. Above 14 not exceeding 15	Feet. Above 15 not exceeding 16	Feet. Above 16 not exceeding 17	Feet. Above 17 not exceeding 18	Feet. Above 18 not exceeding 19	Feet. Above 19 not exceeding 20
			ONE SIDE STRINGER.	<— TWO SIDE STRINGERS. —>					
Feet. Above not exceeding	inches.		inches.	inches.	inches.	inches.	inches.	inches.	inches.
23 and 25	20	Frames							
		Reversed frames ..							
		Depth of framing ..							
25 „ 27	20	Frames							
		Reversed frames ..							
		Depth of framing ..							
27 „ 29	20½	Frames							
		Reversed frames ..							
		Depth of framing ..							
29 „ 31	20½	Frames	3 × 3 × ·28						
		Reversed frames ..	2½ × 2½ × ·28						
		Depth of framing ..	3						
31 „ 33	21	Frames	3 × 3 × ·28	3 × 3 × ·28					
		Reversed frames ..	2½ × 2½ × ·28	3 × 2½ × ·28					
		Depth of framing ..	3	3					
33 „ 35	21	Frames	3 × 3 × ·28	3½ × 3 × ·28	3½ × 3 × ·28				
		Reversed frames ..	3 × 2½ × ·28	3 × 2½ × ·28	3 × 3 × ·28				
		Depth of framing ..	3	3½	3½				
35 „ 37	21½	Frames	3½ × 3 × ·28	3½ × 3 × ·28	4 × 3 × ·28	4 × 3 × ·30			
		Reversed frames ..	3 × 2½ × ·28	3 × 3 × ·28	3 × 3 × ·28	3 × 3 × ·30			
		Depth of framing ..	3½	3½	4	4			
37 „ 39	21½	Frames	3½ × 3 × ·28	4 × 3 × ·28	4 × 3 × ·30	4 × 3 × ·30	4 × 3 × ·32		
		Reversed frames ..	3 × 3 × ·28	3 × 3 × ·28	3 × 3 × ·30	3½ × 3 × ·30	4 × 3 × ·32		
		Depth of framing ..	3½	4	4	4½	5		
39 „ 42	22	Frames	4 × 3 × ·28	4 × 3 × ·30	4 × 3 × ·30	4 × 3 × ·32	4 × 3 × ·34	4 × 3 × ·36	
		Reversed frames ..	3 × 3 × ·28	3 × 3 × ·30	3½ × 3 × ·30	4 × 3 × ·32	4½ × 3 × ·34	4½ × 3 × ·36	
		Depth of framing ..	4	4	4½	5	5½	5½	
42 „ 45	22	Frames	4 × 3 × ·30	4 × 3 × ·30	4 × 3 × ·32	4 × 3 × ·34	4 × 3 × ·36	4½ × 3 × ·36	4½ × 3 × ·38
		Reversed frames ..	3 × 3 × ·30	3½ × 3 × ·30	4 × 3 × ·32	4½ × 3 × ·34	4½ × 3 × ·36	4½ × 3 × ·36	4½ × 3 × ·38
		Depth of framing ..	4	4½	5	5½	5½	6	6
45 „ 48	22½	Frames	4 × 3 × ·30	4 × 3 × ·32	4 × 3 × ·34	4 × 3 × ·36	4½ × 3 × ·36	4½ × 3 × ·38	4½ × 3 × ·38
		Reversed frames ..	3½ × 3 × ·30	4 × 3 × ·32	4½ × 3 × ·34	4½ × 3 × ·36	4½ × 3 × ·36	4½ × 3 × ·38	5 × 3 × ·38
		Depth of framing ..	4½	5	5½	5½	6	6	6½
48 „ 51	22½	Frames	4 × 3 × ·32	4 × 3 × ·34	4 × 3 × ·36	4½ × 3 × ·36	4½ × 3 × ·38	4½ × 3 × ·38	4½ × 3 × ·40
		Reversed frames ..	4 × 3 × ·32	4½ × 3 × ·34	4½ × 3 × ·36	4½ × 3 × ·36	4½ × 3 × ·38	5 × 3 × ·38	5 × 3 × ·40
		Depth of framing ..	5	5½	5½	6	6	6½	6½
51 „ 54	23	Frames	4 × 3 × ·34	4 × 3 × ·36	4½ × 3 × ·36	4½ × 3 × ·38	4½ × 3 × ·38	4½ × 3 × ·40	5 × 3 × ·40
		Reversed frames ..	4½ × 3 × ·34	4½ × 3 × ·36	4½ × 3 × ·36	4½ × 3 × ·38	5 × 3 × ·38	5 × 3 × ·40	5 × 3 × ·40
		Depth of framing ..	5½	5½	6	6	6½	6½	7
54 „ 57	23	Frames	4 × 3 × ·36	4½ × 3 × ·36	4½ × 3 × ·38	4½ × 3 × ·38	4½ × 3 × ·40	5 × 3 × ·40	5 × 3 × ·42
		Reversed frames ..	4½ × 3 × ·36	4½ × 3 × ·36	4½ × 3 × ·38	5 × 3 × ·38	5 × 3 × ·40	5 × 3 × ·40	5 × 3 × ·42
		Depth of framing.	5½	6	6	6½	6½	7	7
57 „ 60	23½	Frames	4½ × 3 × ·36	4½ × 3 × ·38	4½ × 3 × ·38	4½ × 3 × ·40	5 × 3 × ·40	5 × 3 × ·42	5 × 3 × ·42
		Reversed frames ..	4½ × 3 × ·36	4½ × 3 × ·38	5 × 3 × ·38	5 × 3 × ·40	5 × 3 × ·40	5 × 3 × ·42	5½ × 3 × ·42
		Depth of framing ..	6	6	6½	6½	7	7	7½

FRAMES with SINGLE REVERSED FRAMES.

TABLE 2.

(See Continuation.)

TRANSVERSE NUMBER. B + D	FRAME SPACING.		DEPTH (d) AT MIDDLE OF LENGTH FROM TOP OF FLOORS AT CENTRE IN WAY OF SINGLE BOTTOMS, AND FROM TOP OF MARGIN PLATE IN WAY OF DOUBLE BOTTOMS, TO TOP OF LOWEST TIER OF BEAMS AT SIDE. *See* SKETCH ON PAGE 21.						
			Feet. Above 20 and not exceeding 21	Feet. Above 21 and not exceeding 22	Feet. Above 22 and not exceeding 23	Feet. Above 23 and not exceeding 24	Feet. Above 24 and not exceeding 25	Feet. Above 25 and not exceeding 26	Feet. Above 26 and not exceeding 27
			TWO SIDE STRINGERS.	< — — — — — — — — — — — — — — — — THREE SIDE STRINGERS. — — — — — — — — — — — — — — — — >					
Feet. Above / not exceeding	inches.		inches.	inches.	inches.	inches.	inches.	inches.	inches.
23 and 25	20	Frames							
		Reversed frames ..							
		Depth of framing ..							
25 „ 27	20	Frames							
		Reversed frames ..							
		Depth of framing ..							
27 „ 29	$20\frac{1}{2}$	Frames							
		Reversed frames ..							
		Depth of framing ..							
29 „ 31	$20\frac{1}{2}$	Frames							
		Reversed frames ..							
		Depth of framing ..							
31 „ 33	21	Frames							
		Reversed frames ..							
		Depth of framing ..							
33 „ 35	21	Frames							
		Reversed frames ..							
		Depth of framing ..							
35 „ 37	$21\frac{1}{2}$	Frames							
		Reversed frames ..							
		Depth of framing ..							
37 „ 39	$21\frac{1}{2}$	Frames							
		Reversed frames ..							
		Depth of framing ..							
39 „ 42	22	Frames							
		Reversed frames ..							
		Depth of framing ..							
42 „ 45	22	Frames							
		Reversed frames ..							
		Depth of framing ..							
45 „ 48	$22\frac{1}{2}$	Frames	$4\frac{1}{2} \times 3 \times \cdot40$						
		Reversed frames ..	$5 \times 3 \times \cdot40$						
		Depth of framing ..	$6\frac{1}{2}$						
48 „ 51	$22\frac{1}{2}$	Frames	$5 \times 3 \times \cdot40$	$5 \times 3 \times \cdot42$					
		Reversed frames ..	$5 \times 3 \times \cdot40$	$5 \times 3 \times \cdot42$					
		Depth of framing ..	7	7					
51 „ 54	23	Frames	$5 \times 3 \times \cdot42$	$5 \times 3 \times \cdot42$	$5\frac{1}{2} \times 3 \times \cdot44$				
		Reversed frames ..	$5 \times 3 \times \cdot42$	$5\frac{1}{2} \times 3 \times \cdot42$	$5\frac{1}{2} \times 3 \times \cdot44$				
		Depth of framing ..	7	$7\frac{1}{2}$	8				
54 „ 57	23	Frames	$5 \times 3 \times \cdot42$	$5 \times 3 \times \cdot44$	$5\frac{1}{2} \times 3 \times \cdot46$	$5\frac{1}{2} \times 3\frac{1}{2} \times \cdot46$			
		Reversed frames ..	$5\frac{1}{2} \times 3 \times \cdot42$	$5\frac{1}{2} \times 3 \times \cdot44$	$5\frac{1}{2} \times 3 \times \cdot46$	$6 \times 3\frac{1}{2} \times \cdot46$			
		Depth of framing ..	$7\frac{1}{2}$	$7\frac{1}{2}$	8	$8\frac{1}{2}$			
57 „ 60	$23\frac{1}{2}$	Frames	$5 \times 3 \times \cdot44$	$5\frac{1}{2} \times 3 \times \cdot44$	$5\frac{1}{2} \times 3\frac{1}{2} \times \cdot46$	$6 \times 3\frac{1}{2} \times \cdot48$	$6\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$		
		Reversed frames ..	$5\frac{1}{2} \times 3 \times \cdot44$	$5\frac{1}{2} \times 3 \times \cdot44$	$5\frac{1}{2} \times 3\frac{1}{2} \times \cdot46$	$6 \times 3\frac{1}{2} \times \cdot48$	$6\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$		
		Depth of framing ..	$7\frac{1}{2}$	8	8	$8\frac{1}{2}$	$9\frac{1}{2}$		

FRAMES with SINGLE REVERSED FRAMES.

TABLE 2.

(See Continuation.)

TRANSVERSE NUMBER. B + D	FRAME SPACING.†		FRAMING IN PEAKS.	DEPTH (d) AT MIDDLE OF LENGTH FROM TOP OF FLOORS AT CENTRE IN WAY OF SINGLE BOTTOMS, AND FROM TOP OF MARGIN PLATE IN WAY OF DOUBLE BOTTOMS, TO TOP OF LOWEST TIER OF BEAMS AT SIDE. *See* SKETCH ON PAGE 21.					
				Feet. Above 7 not exceeding 8	Feet. Above 8 not exceeding 9	Feet. Above 9 not exceeding 10	Feet. Above 10 not exceeding 11	Feet. Above 11 not exceeding 12	Feet. Above 12 not exceeding 13
				<——————————ONE SIDE STRINGER.——————————>					
Feet. Above 60 not exceeding 63	inches. 23½	Frames	inches. 4½ × 3 × ·32	inches. 4½ × 3 × ·32	inches. 4½ × 3 × ·32	inches. 4½ × 3 × ·34	inches. 4½ × 3 × ·34	inches. 4½ × 3 × ·36	inches. 4½ × 3 × ·36
		Reversed frames ..	3 × 3 × ·32	3 × 3 × ·32	3½ × 3 × ·32	3½ × 3 × ·34	4 × 3 × ·34	4 × 3 × ·36	4½ × 3 × ·36
		Depth of framing ..	4½	4½	5	5	5½	5½	6
63 „ 66	24	Frames	5 × 3 × ·32	5 × 3 × ·32	5 × 3 × ·34	5 × 3 × ·34	5 × 3 × ·36	5 × 3 × ·36	5 × 3 × ·38
		Reversed frames ..	3 × 3 × ·32	3 × 3 × ·32	3 × 3 × ·34	3½ × 3 × ·34	3½ × 3 × ·36	4 × 3 × ·36	4 × 3 × ·38
		Depth of framing ..	5	5	5	5½	5½	6	6
66 „ 69	24	Frames	5 × 3 × ·34	5 × 3 × ·34	5 × 3 × ·34	5 × 3 × ·36	5 × 3 × ·36	5 × 3½ × ·38	5 × 3½ × ·38
		Reversed frames ..	3 × 3 × ·34	3 × 3 × ·34	3½ × 3 × ·34	3½ × 3 × ·36	4 × 3 × ·36	4 × 3½ × ·38	4½ × 3½ × ·38
		Depth of framing ..	5	5	5½	5½	6	6	6½
69 „ 72	24½	Frames	5½ × 3½ × ·34	5½ × 3½ × ·36	5½ × 3½ × ·36	5½ × 3½ × ·36	5½ × 3½ × ·38	5½ × 3½ × ·38	5½ × 3½ × ·40
		Reversed frames ..	3 × 3 × ·34	3 × 3½ × ·36	3 × 3½ × ·36	3½ × 3½ × ·36	3½ × 3½ × ·38	4 × 3½ × ·38	4 × 3½ × ·40
		Depth of framing ..	5½	✲ 5½	✲ 5½	6	6	6½	6½
72 „ 75	24½	Frames	5½ × 3½ × ·34		5½ × 3½ × ·36	5½ × 3½ × ·38	5½ × 3½ × ·38	5½ × 3½ × ·40	5½ × 3½ × ·40
		Reversed frames ..	3 × 3½ × ·34		3½ × 3½ × ·36	3½ × 3½ × ·38	4 × 3½ × ·38	4 × 3½ × ·40	4½ × 3½ × ·40
		Depth of framing ..	5½ ✲		6	6	6½	6½	7
75 „ 78	25	Frames	5½ × 3½ × ·36		5½ × 3½ × ·38	5½ × 3½ × ·38	5½ × 3½ × ·40	5½ × 3½ × ·40	5½ × 3½ × ·42
		Reversed frames ..	3 × 3½ × ·36		3½ × 3½ × ·38	4 × 3½ × ·38	4 × 3½ × ·40	4½ × 3½ × ·40	4½ × 3½ × ·42
		Depth of framing ..	5½ ✲		6	6½	6½	7	7
78 „ 81	25½	Frames	6 × 3½ × ·36		6 × 3½ × ·38	6 × 3½ × ·40	6 × 3½ × ·40	6 × 3½ × ·42	6 × 3½ × ·42
		Reversed frames ..	3 × 3½ × ·36		3½ × 3½ × ·38	3½ × 3½ × ·40	4 × 3½ × ·40	4 × 3½ × ·42	4½ × 3½ × ·42
		Depth of framing ..	6 ✲		6½	6½	7	7	7½
81 „ 84	26	Frames	6 × 3½ × ·38		6 × 3½ × ·40	6 × 3½ × ·40	6 × 3½ × ·42	6 × 3½ × ·42	6 × 3½ × ·44
		Reversed frames ..	3 × 3½ × ·38		3½ × 3½ × ·40	4 × 3½ × ·40	4 × 3½ × ·42	4½ × 3½ × ·42	4½ × 3½ × ·44
		Depth of framing ..	6 ✲		6½	7	7	7½	7½
84 „ 87	26½	Frames	6½ × 3½ × ·38		6½ × 3½ × ·40	6½ × 3½ × ·42	6½ × 3½ × ·42	6½ × 3½ × ·44	6½ × 3½ × ·44
		Reversed frames ..	3 × 3½ × ·38		3½ × 3½ × ·40	3½ × 3½ × ·42	4 × 3½ × ·42	4 × 3½ × ·44	4½ × 3½ × ·44
		Depth of framing ..	6½ ✲		7	7	7½	7½	8
87 „ 90	27	Frames	6½ × 3½ × ·40		6½ × 3½ × ·42	6½ × 3½ × ·42	6½ × 3½ × ·44	6½ × 3½ × ·44	6½ × 3½ × ·46
		Reversed frames ..	3 × 3½ × ·40		3½ × 3½ × ·42	4 × 3½ × ·42	4 × 3½ × ·44	4½ × 3½ × ·44	4½ × 3½ × ·46
		Depth of framing ..	6½ ✲		7	7½	7½	8	8
90 „ 93	27½	Frames	7 × 3½ × ·40		7 × 3½ × ·44	7 × 3½ × ·44	7 × 3½ × ·46	7 × 3½ × ·46	7 × 3½ × ·48
		Reversed frames ..	3 × 3½ × ·40		3½ × 3½ × ·44	4 × 3½ × ·44	4 × 3½ × ·46	4½ × 3½ × ·46	5 × 3½ × ·48
		Depth of framing ..	7 ✲		7½	8	8	8½	8½
93 „ 96	28	Frames	7 × 3½ × ·42		7 × 3½ × ·46	7 × 3½ × ·46	7 × 3½ × ·48	7 × 3½ × ·48	7 × 3½ × ·48
		Reversed frames ..	3 × 3½ × ·42		4 × 3½ × ·46	4½ × 3½ × ·46	5 × 3½ × ·48	5½ × 3½ × ·48	5½ × 3½ × ·48
		Depth of framing ..	7 ✲		8	8½	8½	9	9
96 „ 99	28½	Frames	7 × 3½ × ·42		7 × 3½ × ·48	7 × 3½ × ·48	7 × 3½ × ·48	7 × 3½ × ·48	7 × 3½ × ·48
		Reversed frames ..	3½ × 3½ × ·42		5 × 3½ × ·48	5½ × 3½ × ·48	6 × 3½ × ·48	6 × 3½ × ·48	6½ × 3½ × ·48
		Depth of framing ..	7½		8½	9	9½	9½	10
99 „ 102	29	Frames	7 × 3½ × ·44			7 × 3½ × ·48	7 × 3½ × ·48	7 × 3½ × ·48	6½ × 3½ × ·48
		Reversed frames ..	3½ × 3½ × ·44			6½ × 3½ × ·48	7 × 3½ × ·48	7 × 3½ × ·48	8 × 3½ × ·48
		Depth of framing ..	7½			10	10½	10½	11
102 „ 105	29½	Frames	7 × 3½ × ·44			6½ × 3½ × ·48	6½ × 3½ × ·48	6½ × 3½ × ·50	7 × 3½ × ·50
		Reversed frames ..	4 × 3½ × ·44			8 × 3½ × ·48	8 × 3½ × ·48	8 × 3½ × ·50	8 × 3½ × ·50
		Depth of framing ..	8			11	11	11	11½

✲ The broad flange of the reversed frame is to be fitted in a fore and aft direction.

† The spacing of the frames in the peaks is not to exceed 24 inches where wider spacing is allowed amidships; and from the collision bulkhead to one-fifth the vessel's length from stem the spacing is not to exceed 27 inches unless the frames are doubled to the height of the lowest tier of beams.

FRAMES with SINGLE REVERSED FRAMES.

TABLE 2.

(See Continuation.)

TRANSVERSE NUMBER. B + D	FRAME SPACING †		DEPTH (d) AT MIDDLE OF LENGTH FROM TOP OF FLOORS AT CENTRE IN WAY OF SINGLE BOTTOMS, AND FROM TOP OF MARGIN PLATE IN WAY OF DOUBLE BOTTOMS, TO TOP OF LOWEST TIER OF BEAMS AT SIDE. *See* SKETCH ON PAGE 21.						
			Feet. Above 13 and not exceeding 14	Feet. Above 14 and not exceeding 15	Feet. Above 15 and not exceeding 16	Feet. Above 16 and not exceeding 17	Feet. Above 17 and not exceeding 18	Feet. Above 18 and not exceeding 19	Feet. Above 19 and not exceeding 20
			ONE SIDE STRINGER.	<——— TWO SIDE STRINGERS. ———>					
Feet. Above / not exceeding	inches.		inches.	inches.	inches.	inches.	inches.	inches.	inches.
60 and 63	$23\frac{1}{2}$	Frames	$4\frac{1}{2} \times 3 \times .38$	$4\frac{1}{2} \times 3 \times .38$	$4\frac{1}{2} \times 3 \times .40$	$5 \times 3 \times .40$	$5 \times 3 \times .42$	$5 \times 3 \times .42$	$5 \times 3 \times .44$
		Reversed frames	$4\frac{1}{2} \times 3 \times .38$	$5 \times 3 \times .38$	$5 \times 3 \times .40$	$5 \times 3 \times .40$	$5 \times 3 \times .42$	$5\frac{1}{2} \times 3 \times .42$	$5\frac{1}{2} \times 3 \times .44$
		Depth of framing	6	$6\frac{1}{2}$	$6\frac{1}{2}$	7	7	$7\frac{1}{2}$	$7\frac{1}{2}$
63 „ 66	24	Frames	$5 \times 3 \times .38$	$5 \times 3 \times .40$	$5 \times 3 \times .40$	$5 \times 3 \times .42$	$5 \times 3\frac{1}{2} \times .42$	$5 \times 3\frac{1}{2} \times .42$	$5 \times 3\frac{1}{2} \times .44$
		Reversed frames	$4\frac{1}{2} \times 3 \times .38$	$4\frac{1}{2} \times 3 \times .40$	$5 \times 3 \times .40$	$5 \times 3 \times .42$	$5\frac{1}{2} \times 3\frac{1}{2} \times .42$	$5\frac{1}{2} \times 3\frac{1}{2} \times .42$	$5\frac{1}{2} \times 3\frac{1}{2} \times .44$
		Depth of framing	$6\frac{1}{2}$	$6\frac{1}{2}$	7	7	$7\frac{1}{2}$	$7\frac{1}{2}$	$7\frac{1}{2}$
66 „ 69	24	Frames	$5 \times 3\frac{1}{2} \times .40$	$5 \times 3\frac{1}{2} \times .40$	$5 \times 3\frac{1}{2} \times .42$	$5 \times 3\frac{1}{2} \times .42$	$5 \times 3\frac{1}{2} \times .44$	$5 \times 3\frac{1}{2} \times .44$	$5\frac{1}{2} \times 3\frac{1}{2} \times .44$
		Reversed frames	$4\frac{1}{2} \times 3\frac{1}{2} \times .40$	$5 \times 3\frac{1}{2} \times .40$	$5 \times 3\frac{1}{2} \times .42$	$5\frac{1}{2} \times 3\frac{1}{2} \times .42$	$5\frac{1}{2} \times 3\frac{1}{2} \times .44$	$5\frac{1}{2} \times 3\frac{1}{2} \times .44$	$5\frac{1}{2} \times 3\frac{1}{2} \times .44$
		Depth of framing	$6\frac{1}{2}$	7	7	$7\frac{1}{2}$	$7\frac{1}{2}$	$7\frac{1}{2}$	8
69 „ 72	$24\frac{1}{2}$	Frames	$5\frac{1}{2} \times 3\frac{1}{2} \times .40$	$5\frac{1}{2} \times 3\frac{1}{2} \times .42$	$5\frac{1}{2} \times 3\frac{1}{2} \times .42$	$5\frac{1}{2} \times 3\frac{1}{2} \times .44$	$5\frac{1}{2} \times 3\frac{1}{2} \times .44$	$5\frac{1}{2} \times 3\frac{1}{2} \times .44$	$5\frac{1}{2} \times 3\frac{1}{2} \times .46$
		Reversed frames	$4\frac{1}{2} \times 3\frac{1}{2} \times .40$	$4\frac{1}{2} \times 3\frac{1}{2} \times .42$	$5 \times 3\frac{1}{2} \times .42$	$5 \times 3\frac{1}{2} \times .44$	$5\frac{1}{2} \times 3\frac{1}{2} \times .44$	$5\frac{1}{2} \times 3\frac{1}{2} \times .44$	$5\frac{1}{2} \times 3\frac{1}{2} \times .46$
		Depth of framing	7	7	$7\frac{1}{2}$	$7\frac{1}{2}$	8	8	8
72 „ 75	$24\frac{1}{2}$	Frames	$5\frac{1}{2} \times 3\frac{1}{2} \times .42$	$5\frac{1}{2} \times 3\frac{1}{2} \times .42$	$5\frac{1}{2} \times 3\frac{1}{2} \times .44$	$5\frac{1}{2} \times 3\frac{1}{2} \times .44$	$5\frac{1}{2} \times 3\frac{1}{2} \times .44$	$5\frac{1}{2} \times 3\frac{1}{2} \times .46$	$5\frac{1}{2} \times 3\frac{1}{2} \times .46$
		Reversed frames	$4\frac{1}{2} \times 3\frac{1}{2} \times .42$	$5 \times 3\frac{1}{2} \times .42$	$5 \times 3\frac{1}{2} \times .44$	$5\frac{1}{2} \times 3\frac{1}{2} \times .44$	$5\frac{1}{2} \times 3\frac{1}{2} \times .44$	$5\frac{1}{2} \times 3\frac{1}{2} \times .46$	$6 \times 3\frac{1}{2} \times .46$
		Depth of framing	7	$7\frac{1}{2}$	$7\frac{1}{2}$	8	8	8	$8\frac{1}{2}$
75 „ 78	25	Frames	$5\frac{1}{2} \times 3\frac{1}{2} \times .42$	$5\frac{1}{2} \times 3\frac{1}{2} \times .44$	$5\frac{1}{2} \times 3\frac{1}{2} \times .44$	$5\frac{1}{2} \times 3\frac{1}{2} \times .46$	$5\frac{1}{2} \times 3\frac{1}{2} \times .46$	$5\frac{1}{2} \times 3\frac{1}{2} \times .46$	$6 \times 3\frac{1}{2} \times .48$
		Reversed frames	$5 \times 3\frac{1}{2} \times .42$	$5 \times 3\frac{1}{2} \times .44$	$5\frac{1}{2} \times 3\frac{1}{2} \times .44$	$5\frac{1}{2} \times 3\frac{1}{2} \times .46$	$5\frac{1}{2} \times 3\frac{1}{2} \times .46$	$6 \times 3\frac{1}{2} \times .46$	$6 \times 3\frac{1}{2} \times .48$
		Depth of framing	$7\frac{1}{2}$	$7\frac{1}{2}$	8	8	8	$8\frac{1}{2}$	$8\frac{1}{2}$
78 „ 81	$25\frac{1}{2}$	Frames	$6 \times 3\frac{1}{2} \times .44$	$6 \times 3\frac{1}{2} \times .44$	$6 \times 3\frac{1}{2} \times .46$	$6 \times 3\frac{1}{2} \times .46$	$6 \times 3\frac{1}{2} \times .46$	$6 \times 3\frac{1}{2} \times .48$	$6 \times 3\frac{1}{2} \times .48$
		Reversed frames	$4\frac{1}{2} \times 3\frac{1}{2} \times .44$	$5 \times 3\frac{1}{2} \times .44$	$5 \times 3\frac{1}{2} \times .46$	$5\frac{1}{2} \times 3\frac{1}{2} \times .46$	$5\frac{1}{2} \times 3\frac{1}{2} \times .46$	$6 \times 3\frac{1}{2} \times .48$	$6\frac{1}{2} \times 3\frac{1}{2} \times .48$
		Depth of framing	$7\frac{1}{2}$	8	8	$8\frac{1}{2}$	$8\frac{1}{2}$	$8\frac{1}{2}$	9
81 „ 84	26	Frames	$6 \times 3\frac{1}{2} \times .44$	$6 \times 3\frac{1}{2} \times .46$	$6 \times 3\frac{1}{2} \times .46$	$6 \times 3\frac{1}{2} \times .48$	$6 \times 3\frac{1}{2} \times .48$	$6 \times 3\frac{1}{2} \times .48$	$6\frac{1}{2} \times 3\frac{1}{2} \times .48$
		Reversed frames	$5 \times 3\frac{1}{2} \times .44$	$5 \times 3\frac{1}{2} \times .46$	$5\frac{1}{2} \times 3\frac{1}{2} \times .46$	$6 \times 3\frac{1}{2} \times .48$	$6 \times 3\frac{1}{2} \times .48$	$6\frac{1}{2} \times 3\frac{1}{2} \times .48$	$6\frac{1}{2} \times 3\frac{1}{2} \times .48$
		Depth of framing	8	8	$8\frac{1}{2}$	$8\frac{1}{2}$	$8\frac{1}{2}$	9	$9\frac{1}{2}$
84 „ 87	$26\frac{1}{2}$	Frames	$6\frac{1}{2} \times 3\frac{1}{2} \times .46$	$6\frac{1}{2} \times 3\frac{1}{2} \times .46$	$6\frac{1}{2} \times 3\frac{1}{2} \times .48$	$6\frac{1}{2} \times 3\frac{1}{2} \times .48$	$6\frac{1}{2} \times 3\frac{1}{2} \times .48$	$6\frac{1}{2} \times 3\frac{1}{2} \times .48$	$6\frac{1}{2} \times 3\frac{1}{2} \times .48$
		Reversed frames	$4\frac{1}{2} \times 3\frac{1}{2} \times .46$	$5 \times 3\frac{1}{2} \times .46$	$5\frac{1}{2} \times 3\frac{1}{2} \times .48$	$6 \times 3\frac{1}{2} \times .48$	$6 \times 3\frac{1}{2} \times .48$	$6\frac{1}{2} \times 3\frac{1}{2} \times .48$	$7 \times 3\frac{1}{2} \times .48$
		Depth of framing	8	$8\frac{1}{2}$	$8\frac{1}{2}$	9	9	$9\frac{1}{2}$	10
87 „ 90	27	Frames	$6\frac{1}{2} \times 3\frac{1}{2} \times .46$	$6\frac{1}{2} \times 3\frac{1}{2} \times .48$	$6\frac{1}{2} \times 3\frac{1}{2} \times .48$	$6\frac{1}{2} \times 3\frac{1}{2} \times .48$	$6\frac{1}{2} \times 3\frac{1}{2} \times .48$	$6\frac{1}{2} \times 3\frac{1}{2} \times .48$	$7 \times 3\frac{1}{2} \times .48$
		Reversed frames	$5 \times 3\frac{1}{2} \times .46$	$5\frac{1}{2} \times 3\frac{1}{2} \times .48$	$6 \times 3\frac{1}{2} \times .48$	$6\frac{1}{2} \times 3\frac{1}{2} \times .48$	$6\frac{1}{2} \times 3\frac{1}{2} \times .48$	$7 \times 3\frac{1}{2} \times .48$	$7 \times 3\frac{1}{2} \times .48$
		Depth of framing	$8\frac{1}{2}$	$8\frac{1}{2}$	9	$9\frac{1}{2}$	$9\frac{1}{2}$	10	$10\frac{1}{2}$
90 „ 93	$27\frac{1}{2}$	Frames	$7 \times 3\frac{1}{2} \times .48$	$7 \times 3\frac{1}{2} \times .48$	$7 \times 3\frac{1}{2} \times .48$	$7 \times 3\frac{1}{2} \times .48$	$7 \times 3\frac{1}{2} \times .48$	$6\frac{1}{2} \times 3\frac{1}{2} \times .48$	$6\frac{1}{2} \times 3\frac{1}{2} \times .50$
		Reversed frames	$5 \times 3\frac{1}{2} \times .48$	$5\frac{1}{2} \times 3\frac{1}{2} \times .48$	$6 \times 3\frac{1}{2} \times .48$	$6\frac{1}{2} \times 3\frac{1}{2} \times .48$	$7 \times 3\frac{1}{2} \times .48$	$8 \times 3\frac{1}{2} \times .48$	$8 \times 3\frac{1}{2} \times .50$
		Depth of framing	$8\frac{1}{2}$	9	$9\frac{1}{2}$	10	$10\frac{1}{2}$	11	11
93 „ 96	28	Frames	$7 \times 3\frac{1}{2} \times .48$	$7 \times 3\frac{1}{2} \times .48$	$7 \times 3\frac{1}{2} \times .48$	$6\frac{1}{2} \times 3\frac{1}{2} \times .48$	$6\frac{1}{2} \times 3\frac{1}{2} \times .50$	$7 \times 3\frac{1}{2} \times .50$	$7 \times 3\frac{1}{2} \times .52$
		Reversed frames	$6 \times 3\frac{1}{2} \times .48$	$6\frac{1}{2} \times 3\frac{1}{2} \times .48$	$7 \times 3\frac{1}{2} \times .48$	$8 \times 3\frac{1}{2} \times .48$	$8 \times 3\frac{1}{2} \times .50$	$8 \times 3\frac{1}{2} \times .50$	$8 \times 3\frac{1}{2} \times .52$
		Depth of framing	$9\frac{1}{2}$	10	$10\frac{1}{2}$	11	11	$11\frac{1}{2}$	$11\frac{1}{2}$
96 „ 99	$28\frac{1}{2}$	Frames	$7 \times 3\frac{1}{2} \times .48$	$6\frac{1}{2} \times 3\frac{1}{2} \times .48$	$6\frac{1}{2} \times 3\frac{1}{2} \times .50$	$7 \times 3\frac{1}{2} \times .50$	$7 \times 3\frac{1}{2} \times .52$	$7 \times 3\frac{1}{2} \times .52$	$8 \times 3\frac{1}{2} \times .52$
		Reversed frames	$7 \times 3\frac{1}{2} \times .48$	$8 \times 3\frac{1}{2} \times .48$	$8 \times 3\frac{1}{2} \times .50$	$8 \times 3\frac{1}{2} \times .50$	$8 \times 3\frac{1}{2} \times .52$	$8 \times 4 \times .52$	$8 \times 3\frac{1}{2} \times .52$
		Depth of framing	$10\frac{1}{2}$	11	11	$11\frac{1}{2}$	$11\frac{1}{2}$	$11\frac{1}{2}$	$12\frac{1}{2}$
99 „ 102	29	Frames	$6\frac{1}{2} \times 3\frac{1}{2} \times .52$	$7 \times 3\frac{1}{2} \times .50$	$7 \times 3\frac{1}{2} \times .52$	$7 \times 3\frac{1}{2} \times .52$	$8 \times 3\frac{1}{2} \times .52$	$8 \times 3\frac{1}{2} \times .54$	$8 \times 3\frac{1}{2} \times .54$
		Reversed frames	$8 \times 3\frac{1}{2} \times .52$	$8 \times 3\frac{1}{2} \times .50$	$8 \times 3\frac{1}{2} \times .52$	$8 \times 4 \times .52$	$8 \times 3\frac{1}{2} \times .52$	$8 \times 3\frac{1}{2} \times .54$	$8 \times 4 \times .54$
		Depth of framing	11	$11\frac{1}{2}$	$11\frac{1}{2}$	$11\frac{1}{2}$	$12\frac{1}{2}$	$12\frac{1}{2}$	$12\frac{1}{2}$
102 „ 105	$29\frac{1}{2}$	Frames	$7 \times 3\frac{1}{2} \times .52$	$7 \times 3\frac{1}{2} \times .52$	$8 \times 3\frac{1}{2} \times .52$	$8 \times 3\frac{1}{2} \times .54$	$8 \times 3\frac{1}{2} \times .54$		
		Reversed frames	$8 \times 3\frac{1}{2} \times .52$	$8 \times 4 \times .52$	$8 \times 3\frac{1}{2} \times .52$	$8 \times 3\frac{1}{2} \times .54$	$8 \times 4 \times .54$		
		Depth of framing	$11\frac{1}{2}$	$11\frac{1}{2}$	$12\frac{1}{2}$	$12\frac{1}{2}$	$12\frac{1}{2}$		

† The spacing of the frames in the peaks is not to exceed 24 inches where wider spacing is allowed amidships; and from the collision bulkhead to one-fifth the vessel's length from stem the spacing is not to exceed 27 inches unless the frames are doubled to the height of the lowest tier of beams.

FRAMES with SINGLE REVERSED FRAMES.

TABLE 2. *(Concluded.)*

TRANSVERSE NUMBER. B + D	FRAME SPACING.†		DEPTH (d) AT MIDDLE OF LENGTH FROM TOP OF FLOORS AT CENTRE IN WAY OF SINGLE BOTTOMS, AND FROM TOP OF MARGIN PLATE IN WAY OF DOUBLE BOTTOMS, TO TOP OF LOWEST TIER OF BEAMS AT SIDE. *See* SKETCH ON PAGE 21.						
			Feet. Above 20 and not exceeding 21	Feet. Above 21 and not exceeding 22	Feet. Above 22 and not exceeding 23	Feet. Above 23 and not exceeding 24	Feet. Above 24 and not exceeding 25	Feet. Above 25 and not exceeding 26	Feet. Above 26 and not exceeding 27
			TWO SIDE STRINGERS.	<— THREE SIDE STRINGERS. —>					
Feet Above not exceeding	inches.		inches.	inches.	inches.	inches.	inches.	inches.	inches.
60 and 63	$23\frac{1}{2}$	Frames	$5\frac{1}{2} \times 3 \times \cdot44$	$5\frac{1}{2} \times 3 \times \cdot46$	$5\frac{1}{2} \times 3\frac{1}{2} \times \cdot46$	$6 \times 3\frac{1}{2} \times \cdot48$	$6\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$	$6\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$	
		Reversed frames ..	$5\frac{1}{2} \times 3 \times \cdot44$	$5\frac{1}{2} \times 3 \times \cdot46$	$6 \times 3\frac{1}{2} \times \cdot46$	$6\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$	$7 \times 3\frac{1}{2} \times \cdot48$	$8 \times 3\frac{1}{2} \times \cdot48$	
		Depth of framing ..	8	8	$8\frac{1}{2}$	9	10	11	
63 „ 66	24	Frames	$5\frac{1}{2} \times 3\frac{1}{2} \times \cdot44$	$5\frac{1}{2} \times 3\frac{1}{2} \times \cdot46$	$6 \times 3\frac{1}{2} \times \cdot48$	$6\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$	$7 \times 3\frac{1}{2} \times \cdot48$	$6\frac{1}{2} \times 3\frac{1}{2} \times \cdot50$	$7 \times 3\frac{1}{2} \times \cdot52$
		Reversed frames ..	$5\frac{1}{2} \times 3\frac{1}{2} \times \cdot44$	$5\frac{1}{2} \times 3\frac{1}{2} \times \cdot46$	$6 \times 3\frac{1}{2} \times \cdot48$	$6\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$	$7 \times 3\frac{1}{2} \times \cdot48$	$8 \times 3\frac{1}{2} \times \cdot50$	$8 \times 3\frac{1}{2} \times \cdot52$
		Depth of framing ..	8	8	$8\frac{1}{2}$	$9\frac{1}{2}$	$10\frac{1}{2}$	11	$11\frac{1}{2}$
66 „ 69	24	Frames	$5\frac{1}{2} \times 3\frac{1}{2} \times \cdot46$	$5\frac{1}{2} \times 3\frac{1}{2} \times \cdot46$	$6 \times 3\frac{1}{2} \times \cdot48$	$6\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$	$6\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$	$7 \times 3\frac{1}{2} \times \cdot50$	$7 \times 3\frac{1}{2} \times \cdot52$
		Reversed frames ..	$5\frac{1}{2} \times 3\frac{1}{2} \times \cdot46$	$6 \times 3\frac{1}{2} \times \cdot46$	$6\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$	$7 \times 3\frac{1}{2} \times \cdot48$	$8 \times 3\frac{1}{2} \times \cdot48$	$8 \times 3\frac{1}{2} \times \cdot50$	$8 \times 4 \times \cdot52$
		Depth of framing ..	8	$8\frac{1}{2}$	9	10	11	$11\frac{1}{2}$	$11\frac{1}{2}$
69 „ 72	$24\frac{1}{2}$	Frames	$5\frac{1}{2} \times 3\frac{1}{2} \times \cdot46$	$6 \times 3\frac{1}{2} \times \cdot48$	$6\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$	$7 \times 3\frac{1}{2} \times \cdot48$	$6\frac{1}{2} \times 3\frac{1}{2} \times \cdot50$	$7 \times 3\frac{1}{2} \times \cdot52$	$8 \times 3\frac{1}{2} \times \cdot52$
		Reversed frames ..	$6 \times 3\frac{1}{2} \times \cdot46$	$6 \times 3\frac{1}{2} \times \cdot48$	$6\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$	$7 \times 3\frac{1}{2} \times \cdot48$	$8 \times 3\frac{1}{2} \times \cdot50$	$8 \times 3\frac{1}{2} \times \cdot52$	$8 \times 3\frac{1}{2} \times \cdot52$
		Depth of framing ..	$8\frac{1}{2}$	$8\frac{1}{2}$	$9\frac{1}{2}$	$10\frac{1}{2}$	11	$11\frac{1}{2}$	$12\frac{1}{2}$
72 „ 75	$24\frac{1}{2}$	Frames	$6 \times 3\frac{1}{2} \times \cdot48$	$6 \times 3\frac{1}{2} \times \cdot48$	$6\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$	$6\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$	$7 \times 3\frac{1}{2} \times \cdot50$	$7 \times 3\frac{1}{2} \times \cdot52$	$8 \times 3\frac{1}{2} \times \cdot54$
		Reversed frames ..	$6 \times 3\frac{1}{2} \times \cdot48$	$6\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$	$7 \times 3\frac{1}{2} \times \cdot48$	$8 \times 3\frac{1}{2} \times \cdot48$	$8 \times 3\frac{1}{2} \times \cdot50$	$8 \times 4 \times \cdot52$	$8 \times 3\frac{1}{2} \times \cdot54$
		Depth of framing ..	$8\frac{1}{2}$	9	10	11	$11\frac{1}{2}$	$11\frac{1}{2}$	$12\frac{1}{2}$
75 „ 78	25	Frames	$6 \times 3\frac{1}{2} \times \cdot48$	$6\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$	$7 \times 3\frac{1}{2} \times \cdot48$	$6\frac{1}{2} \times 3\frac{1}{2} \times \cdot50$	$7 \times 3\frac{1}{2} \times \cdot52$	$8 \times 3\frac{1}{2} \times \cdot52$	$8 \times 3\frac{1}{2} \times \cdot54$
		Reversed frames ..	$6\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$	$6\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$	$7 \times 3\frac{1}{2} \times \cdot48$	$8 \times 3\frac{1}{2} \times \cdot50$	$8 \times 3\frac{1}{2} \times \cdot52$	$8 \times 3\frac{1}{2} \times \cdot52$	$8 \times 4 \times \cdot54$
		Depth of framing ..	9	$9\frac{1}{2}$	$10\frac{1}{2}$	11	$11\frac{1}{2}$	$12\frac{1}{2}$	$12\frac{1}{2}$
78 „ 81	$25\frac{1}{2}$	Frames	$6\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$	$6\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$	$6\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$	$7 \times 3\frac{1}{2} \times \cdot50$	$7 \times 3\frac{1}{2} \times \cdot52$	$8 \times 3\frac{1}{2} \times \cdot54$	$8 \times 3\frac{1}{2} \times \cdot56$
		Reversed frames ..	$6\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$	$7 \times 3\frac{1}{2} \times \cdot48$	$8 \times 3\frac{1}{2} \times \cdot48$	$8 \times 3\frac{1}{2} \times \cdot50$	$8 \times 4 \times \cdot52$	$8 \times 3\frac{1}{2} \times \cdot54$	$8 \times 4 \times \cdot56$
		Depth of framing ..	$9\frac{1}{2}$	10	11	$11\frac{1}{2}$	$11\frac{1}{2}$	$12\frac{1}{2}$	$12\frac{1}{2}$
81 „ 84	26	Frames	$6\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$	$7 \times 3\frac{1}{2} \times \cdot48$	$6\frac{1}{2} \times 3\frac{1}{2} \times \cdot50$	$7 \times 3\frac{1}{2} \times \cdot52$	$8 \times 3\frac{1}{2} \times \cdot52$	$8 \times 3\frac{1}{2} \times \cdot54$	$8 \times 3\frac{1}{2} \times \cdot54$
		Reversed frames ..	$7 \times 3\frac{1}{2} \times \cdot48$	$7 \times 3\frac{1}{2} \times \cdot48$	$8 \times 3\frac{1}{2} \times \cdot50$	$8 \times 3\frac{1}{2} \times \cdot52$	$8 \times 3\frac{1}{2} \times \cdot52$	$8 \times 4 \times \cdot54$	$9 \times 4 \times \cdot54$
		Depth of framing ..	10	$10\frac{1}{2}$	11	$11\frac{1}{2}$	$12\frac{1}{2}$	$12\frac{1}{2}$	$13\frac{1}{2}$
84 „ 87	$26\frac{1}{2}$	Frames	$7 \times 3\frac{1}{2} \times \cdot48$	$6\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$	$7 \times 3\frac{1}{2} \times \cdot50$	$7 \times 3\frac{1}{2} \times \cdot52$	$8 \times 3\frac{1}{2} \times \cdot54$	$8 \times 3\frac{1}{2} \times \cdot56$	$8 \times 3\frac{1}{2} \times \cdot56$
		Reversed frames ..	$7 \times 3\frac{1}{2} \times \cdot48$	$8 \times 3\frac{1}{2} \times \cdot48$	$8 \times 3\frac{1}{2} \times \cdot50$	$8 \times 4 \times \cdot52$	$8 \times 3\frac{1}{2} \times \cdot54$	$8 \times 4 \times \cdot56$	$9 \times 4 \times \cdot56$
		Depth of framing ..	$10\frac{1}{2}$	11	$11\frac{1}{2}$	$11\frac{1}{2}$	$12\frac{1}{2}$	$12\frac{1}{2}$	$13\frac{1}{2}$
87 „ 90	27	Frames	$6\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$	$6\frac{1}{2} \times 3\frac{1}{2} \times \cdot50$	$7 \times 3\frac{1}{2} \times \cdot52$	$8 \times 3\frac{1}{2} \times \cdot52$	$8 \times 3\frac{1}{2} \times \cdot54$	$8 \times 3\frac{1}{2} \times \cdot54$	$8 \times 3\frac{1}{2} \times \cdot54$
		Reversed frames ..	$8 \times 3\frac{1}{2} \times \cdot48$	$8 \times 3\frac{1}{2} \times \cdot50$	$8 \times 3\frac{1}{2} \times \cdot52$	$8 \times 3\frac{1}{2} \times \cdot52$	$8 \times 4 \times \cdot54$	$9 \times 4 \times \cdot54$	$10 \times 4 \times \cdot54$
		Depth of framing ..	11	11	$11\frac{1}{2}$	$12\frac{1}{2}$	$12\frac{1}{2}$	$13\frac{1}{2}$	$14\frac{1}{2}$
90 „ 93	$27\frac{1}{2}$	Frames	$7 \times 3\frac{1}{2} \times \cdot50$	$7 \times 3\frac{1}{2} \times \cdot52$	$8 \times 3\frac{1}{2} \times \cdot52$	$8 \times 3\frac{1}{2} \times \cdot54$	$8 \times 3\frac{1}{2} \times \cdot54$	$8 \times 3\frac{1}{2} \times \cdot54$	$8 \times 3\frac{1}{2} \times \cdot58$
		Reversed frames ..	$8 \times 3\frac{1}{2} \times \cdot50$	$8 \times 3\frac{1}{2} \times \cdot52$	$8 \times 3\frac{1}{2} \times \cdot52$	$8 \times 4 \times \cdot54$	$9 \times 4 \times \cdot54$	$10 \times 4 \times \cdot54$	$10 \times 4 \times \cdot58$
		Depth of framing ..	$11\frac{1}{2}$	$11\frac{1}{2}$	$12\frac{1}{2}$	$12\frac{1}{2}$	$13\frac{1}{2}$	$14\frac{1}{2}$	$14\frac{1}{2}$
93 „ 96	28	Frames	$7 \times 3\frac{1}{2} \times \cdot52$	$8 \times 3\frac{1}{2} \times \cdot52$	$8 \times 3\frac{1}{2} \times \cdot54$	$8 \times 3\frac{1}{2} \times \cdot54$	$8 \times 3\frac{1}{2} \times \cdot54$		
		Reversed frames ..	$8 \times 4 \times \cdot52$	$8 \times 3\frac{1}{2} \times \cdot52$	$8 \times 4 \times \cdot54$	$9 \times 4 \times \cdot54$	$10 \times 4 \times \cdot54$		
		Depth of framing ..	$11\frac{1}{2}$	$12\frac{1}{2}$	$12\frac{1}{2}$	$13\frac{1}{2}$	$14\frac{1}{2}$		
96 „ 99	$28\frac{1}{2}$	Frames	$8 \times 3\frac{1}{2} \times \cdot54$	$8 \times 3\frac{1}{2} \times \cdot54$	$8 \times 3\frac{1}{2} \times \cdot54$				
		Reversed frames ..	$8 \times 3\frac{1}{2} \times \cdot54$	$8 \times 4 \times \cdot54$	$9 \times 4 \times \cdot54$				
		Depth of framing ..	$12\frac{1}{2}$	$12\frac{1}{2}$	$13\frac{1}{2}$				
99 „ 102	29	Frames							
		Reversed frames ..							
		Depth of framing ..							
102 „ 105	$29\frac{1}{2}$	Frames							
		Reversed frames ..							
		Depth of framing ..							

† The spacing of the frames in the peaks is not to exceed 24 inches where wider spacing is allowed amidships; and from the collision bulkhead to one-fifth the vessel's length from stem the spacing is not to exceed 27 inches unless the frames are doubled to the height of the lowest tier of beams.

FRAMES formed of SINGLE ANGLES or BULB ANGLES. TABLE 3.

(See Continuation.)

TRANSVERSE NUMBER. B + D	Spacing of Frames. *		FRAMES IN PEAKS.	DEPTH (d) AT MIDDLE OF LENGTH FROM TOP OF FLOORS AT CENTRE IN WAY OF SINGLE BOTTOMS, AND FROM TOP OF MARGIN PLATE IN WAY OF DOUBLE BOTTOMS, TO TOP OF LOWEST TIER OF BEAMS, AT SIDE. *See* SKETCH ON PAGE 21.				
				Feet. Above 7 and not exceeding 8	Feet. Above 8 and not exceeding 9	Feet. Above 9 and not exceeding 10	Feet. Above 10 and not exceeding 11	Feet. Above 11 and not exceeding 12
				ONE SIDE STRINGER.				
Feet. Above 23 and not exceeding 25	inches. 20	ANGLES.	inches. $3\frac{1}{2} \times 2\frac{1}{2} \times \cdot24$	inches. $3\frac{1}{2} \times 2\frac{1}{2} \times \cdot24$	inches. $3\frac{1}{2} \times 2\frac{1}{2} \times \cdot26$	inches. $4 \times 2\frac{1}{2} \times \cdot26$	inches. $4 \times 2\frac{1}{2} \times \cdot28$	inches.
25 „ 27	20		$3\frac{1}{2} \times 2\frac{1}{2} \times \cdot26$	$3\frac{1}{2} \times 2\frac{1}{2} \times \cdot26$	$4 \times 2\frac{1}{2} \times \cdot26$	$4 \times 2\frac{1}{2} \times \cdot28$	$4 \times 2\frac{1}{2} \times \cdot30$	$4 \times 2\frac{1}{2} \times \cdot32$
27 „ 29	$20\frac{1}{2}$		$4 \times 2\frac{1}{2} \times \cdot26$	$4 \times 2\frac{1}{2} \times \cdot26$	$4 \times 2\frac{1}{2} \times \cdot28$	$4 \times 2\frac{1}{2} \times \cdot30$	$4 \times 2\frac{1}{2} \times \cdot32$	$4 \times 2\frac{1}{2} \times \cdot32$
29 „ 31	$20\frac{1}{2}$		$4 \times 2\frac{1}{2} \times \cdot28$	$4 \times 2\frac{1}{2} \times \cdot28$	$4 \times 2\frac{1}{2} \times \cdot30$	$4 \times 2\frac{1}{2} \times \cdot32$	$4 \times 2\frac{1}{2} \times \cdot32$	$4 \times 3 \times \cdot32$
31 „ 33	21		$4 \times 2\frac{1}{2} \times \cdot30$	$4 \times 2\frac{1}{2} \times \cdot30$	$4 \times 2\frac{1}{2} \times \cdot32$	$4 \times 2\frac{1}{2} \times \cdot32$	$4 \times 3 \times \cdot32$	$4\frac{1}{2} \times 3 \times \cdot32$
33 „ 35	21		$4 \times 2\frac{1}{2} \times \cdot32$	$4 \times 2\frac{1}{2} \times \cdot32$	$4 \times 2\frac{1}{2} \times \cdot32$	$4 \times 3 \times \cdot32$	$4\frac{1}{2} \times 3 \times \cdot32$	$4\frac{1}{2} \times 3 \times \cdot34$
35 „ 37	$21\frac{1}{2}$		$4 \times 2\frac{1}{2} \times \cdot34$	$4 \times 2\frac{1}{2} \times \cdot34$	$4 \times 3 \times \cdot32$	$4\frac{1}{2} \times 3 \times \cdot32$	$4\frac{1}{2} \times 3 \times \cdot34$	$4\frac{1}{2} \times 3 \times \cdot34$
37 „ 39	$21\frac{1}{2}$		$4 \times 3 \times \cdot34$	$4 \times 3 \times \cdot34$	$4\frac{1}{2} \times 3 \times \cdot32$	$4\frac{1}{2} \times 3 \times \cdot34$	$4\frac{1}{2} \times 3 \times \cdot34$	$4\frac{1}{2} \times 3 \times \cdot36$
39 „ 42	22		$4 \times 3 \times \cdot34$	$4 \times 3 \times \cdot34$	$4\frac{1}{2} \times 3 \times \cdot34$	$4\frac{1}{2} \times 3 \times \cdot34$	$4\frac{1}{2} \times 3 \times \cdot36$	$5 \times 3 \times \cdot36$
42 „ 45	22		$4\frac{1}{2} \times 3 \times \cdot34$	$4\frac{1}{2} \times 3 \times \cdot34$	$4\frac{1}{2} \times 3 \times \cdot34$	$4\frac{1}{2} \times 3 \times \cdot36$	$5 \times 3 \times \cdot36$	$5 \times 3 \times \cdot38$
45 „ 48	$22\frac{1}{2}$		$5 \times 3 \times \cdot36$	$5 \times 3 \times \cdot36$	$5 \times 3 \times \cdot36$	$5 \times 3 \times \cdot38$	$5 \times 3 \times \cdot40$	$5 \times 3 \times \cdot34$
48 „ 51	$22\frac{1}{2}$		$5 \times 3 \times \cdot38$	$5 \times 3 \times \cdot38$	$5\frac{1}{2} \times 3 \times \cdot38$	$5\frac{1}{2} \times 3 \times \cdot40$	$5 \times 3 \times \cdot36$	$5\frac{1}{2} \times 3 \times \cdot36$
51 „ 54	23		$5\frac{1}{2} \times 3 \times \cdot38$	$5\frac{1}{2} \times 3 \times \cdot38$	$5\frac{1}{2} \times 3 \times \cdot40$	$5\frac{1}{2} \times 3 \times \cdot36$	$5\frac{1}{2} \times 3 \times \cdot38$	$5\frac{1}{2} \times 3 \times \cdot38$
54 „ 57	23		$5\frac{1}{2} \times 3 \times \cdot40$	$5\frac{1}{2} \times 3 \times \cdot40$	$5\frac{1}{2} \times 3 \times \cdot36$	$5\frac{1}{2} \times 3 \times \cdot38$	$6 \times 3 \times \cdot38$	$6 \times 3 \times \cdot40$
57 „ 60	$23\frac{1}{2}$	BULB ANGLES.	$5\frac{1}{2} \times 3 \times \cdot36$	$5\frac{1}{2} \times 3 \times \cdot36$	$5\frac{1}{2} \times 3 \times \cdot38$	$6 \times 3 \times \cdot38$	$6 \times 3 \times \cdot40$	$6\frac{1}{2} \times 3 \times \cdot40$
60 „ 63	$23\frac{1}{2}$		$5\frac{1}{2} \times 3 \times \cdot38$	$5\frac{1}{2} \times 3 \times \cdot38$	$6 \times 3 \times \cdot38$	$6 \times 3 \times \cdot40$	$6\frac{1}{2} \times 3 \times \cdot40$	$6\frac{1}{2} \times 3 \times \cdot42$
63 „ 66	24		$6 \times 3 \times \cdot38$	$6 \times 3 \times \cdot38$	$6 \times 3 \times \cdot40$	$6\frac{1}{2} \times 3 \times \cdot40$	$6\frac{1}{2} \times 3 \times \cdot42$	$7 \times 3 \times \cdot42$
66 „ 69	24		$6 \times 3 \times \cdot40$	$6 \times 3 \times \cdot40$	$6\frac{1}{2} \times 3 \times \cdot40$	$6\frac{1}{2} \times 3 \times \cdot42$	$7 \times 3 \times \cdot42$	$7 \times 3\frac{1}{2} \times \cdot44$
69 „ 72	$24\frac{1}{2}$		$6\frac{1}{2} \times 3\frac{1}{2} \times \cdot40$	$6\frac{1}{2} \times 3\frac{1}{2} \times \cdot42$	$6\frac{1}{2} \times 3\frac{1}{2} \times \cdot42$	$7 \times 3\frac{1}{2} \times \cdot42$	$7 \times 3\frac{1}{2} \times \cdot44$	$7\frac{1}{2} \times 3\frac{1}{2} \times \cdot44$

* The spacing of the frames in the peaks is not to exceed 24 inches where wider spacing is allowed amidships.

FRAMES formed of SINGLE ANGLES, BULB ANGLES or CHANNELS.

TABLE 3.

(See Continuation.)

TRANSVERSE NUMBER. B + D	SPACING OF FRAMES.*		DEPTH (d) AT MIDDLE OF LENGTH FROM TOP OF FLOORS AT CENTRE IN WAY OF SINGLE BOTTOMS, AND FROM TOP OF MARGIN PLATE IN WAY OF DOUBLE BOTTOMS, TO TOP OF LOWEST TIER OF BEAMS, AT SIDE. *See* SKETCH ON PAGE 21.				
			Feet. Above 12 and not exceeding 13	Feet. Above 13 and not exceeding 14	Feet. Above 14 and not exceeding 15	Feet. Above 15 and not exceeding 16	Feet. Above 16 and not exceeding 17
			ONE SIDE STRINGER.		TWO SIDE STRINGERS.		
Feet. Above 23 and not exceeding 25	inches.	ANGLES.	inches.	inches	inches.	inches.	inches.
25 „ 27	20						
27 „ 29	20½		4 × 3 × ·32				
29 „ 31	20½		4½ × 3 × ·32	4½ × 3 × ·34			
31 „ 33	21		4½ × 3 × ·34	4½ × 3 × ·34	4½ × 3 × ·36		
33 „ 35	21		4½ × 3 × ·34	4½ × 3 × ·36	5 × 3 × ·36	5 × 3 × ·38	
35 „ 37	21½		4½ × 3 × ·36	5 × 3 × ·36	5 × 3 × ·38	5 × 3 × ·34	5 × 3 × ·36
37 „ 39	21½		5 × 3 × ·36	5 × 3 × ·38	5 × 3 × ·34	5 × 3 × ·36	5½ × 3 × ·36
39 „ 42	22		5 × 3 × ·38	5 × 3 × ·34	5 × 3 × ·36	5½ × 3 × ·36	6 × 3 × ·38
42 „ 45	22	BULB ANGLES.	5 × 3 × ·34	5 × 3 × ·36	5½ × 3 × ·36	6 × 3 × ·38	6½ × 3 × ·40
45 „ 48	22½		5 × 3 × ·36	5½ × 3 × ·36	6 × 3 × ·38	6½ × 3 × ·40	6½ × 3 × ·42
48 „ 51	22½		5½ × 3 × ·38	6 × 3 × ·38	6½ × 3 × ·40	6½ × 3 × ·42	7 × 3 × ·42
51 „ 54	23		6 × 3 × ·38	6½ × 3 × ·40	6½ × 3 × ·42	7 × 3 × ·42	7 × 3 × ·44
54 „ 57	23		6½ × 3 × ·40	6½ × 3 × ·42	7 × 3 × ·42	7 × 3 × ·44	7½ × 3 × ·44
57 „ 60	23½		6½ × 3 × ·42	7 × 3 × ·42	7 × 3 × ·44	7½ × 3 × ·44	7½ × 3 × ·46
60 „ 63	23½		7 × 3 × ·42	7 × 3 × ·44	7½ × 3 × ·44	7½ × 3 × ·46	8 × 3 × ·46
63 „ 66	24		7 × 3 × ·44	7½ × 3 × ·44	7½ × 3 × ·46	8 × 3 × ·46	8 × 3 × ·48
66 „ 69	24		7½ × 3½ × ·44	7½ × 3½ × ·46	8 × 3½ × ·46	8 × 3½ × ·48	7½ × 3½ × 3½ × ·42 8½ × 3½ × ·48
69 „ 72	24½		7½ × 3½ × ·46	8 × 3½ × ·46	8 × 3½ × ·48	7½ × 3½ × 3½ × ·42 8½ × 3½ × ·48	7½ × 3½ × 3½ × ·44 8½ × 3½ × ·50

* The spacing of the frames in the peaks is not to exceed 24 inches where wider spacing is allowed amidships.

FRAMES formed of BULB ANGLES or CHANNELS.

TABLE 3.

(See Continuation.)

TRANSVERSE NUMBER. B + D	SPACING OF FRAMES.*		DEPTH (d) AT MIDDLE OF LENGTH, FROM TOP OF FLOORS AT CENTRE IN WAY OF SINGLE BOTTOMS, AND FROM TOP OF MARGIN PLATE IN WAY OF DOUBLE BOTTOMS, TO TOP OF LOWEST TIER OF BEAMS, AT SIDE. *See* SKETCH ON PAGE 21.				
			Feet. Above / not exceeding: 17 and 18	Feet. Above / not exceeding: 18 and 19	Feet. Above / not exceeding: 19 and 20	Feet. Above / not exceeding: 20 and 21	Feet. Above / not exceeding: 21 and 22
			<——— TWO SIDE STRINGERS ———>				THREE SIDE STRINGERS.
Feet. Above / not exceeding: 23 and 25	inches. 20		inches.	inches.	inches.	inches.	inches.
25 „ 27	20						
27 „ 29	20½						
29 „ 31	20½						
31 „ 33	21						
33 „ 35	21						
35 „ 37	21½						
37 „ 39	21½	BULB ANGLES.	6 × 3 × ·38				
39 „ 42	22		6½ × 3 × ·40	6½ × 3 × ·42			
42 „ 45	22		6½ × 3 × ·42	7 × 3 × ·42	7 × 3 × ·44		
45 „ 48	22½		7 × 3 × ·42	7 × 3 × ·44	7½ × 3 × ·44	7½ × 3 × ·46	
48 „ 51	22½		7 × 3 × ·44	7½ × 3 × ·44	7½ × 3 × ·46	8 × 3 × ·46	8 × 3 × ·48
51 „ 54	23		7½ × 3 × ·44	7½ × 3 × ·46	8 × 3 × ·46	8 × 3 × ·48	8½ × 3 × ·48
54 „ 57	23		7½ × 3 × ·46	8 × 3 × ·46	8 × 3 × ·48	8½ × 3 × ·48	8½ × 3 × ·50
57 „ 60	23½		8 × 3 × ·46	8 × 3 × ·48	8½ × 3 × ·48	8½ × 3 × ·50	9 × 3 × ·50
60 „ 63	23½		8 × 3 × ·48	8½ × 3 × ·48	8½ × 3 × ·50	9 × 3 × ·50	9 × 3 × ·52
63 „ 66	24	CHANNELS OR BULB ANGLES.	7½ × 3½ × 3½ × ·42 8½ × 3½ × ·48	7½ × 3½ × 3½ × ·42 8½ × 3½ × ·48	7½ × 3½ × 3½ × ·44 8½ × 3½ × ·50	8 × 3½ × 3½ × ·44 9 × 3½ × ·50	8 × 3½ × 3½ × ·46 9 × 3½ × ·52
66 „ 69	24		7½ × 3½ × 3½ × ·44 8½ × 3½ × ·50	7½ × 3½ × 3½ × ·44 8½ × 3½ × ·50	8 × 3½ × 3½ × ·44 9 × 3½ × ·50	8 × 3½ × 3½ × ·46 9 × 3½ × ·52	8½ × 3½ × 3½ × ·46 9½ × 3½ × ·52
69 „ 72	24½		8 × 3½ × 3½ × ·44 9 × 3½ × ·50	8 × 3½ × 3½ × ·44 9 × 3½ × ·50	8 × 3½ × 3½ × ·46 9 × 3½ × ·52	8½ × 3½ × 3½ × ·46 9½ × 3½ × ·52	8½ × 3½ × 3½ × ·48 9½ × 3½ × ·54

* The spacing of the frames in the peaks is not to exceed 24 inches where wider spacing is allowed amidships.

FRAMES formed of BULB ANGLES or CHANNELS.

TABLE 3.

(See Continuation.)

TRANSVERSE NUMBER. B + D	SPACING OF FRAMES.*		DEPTH (d) AT MIDDLE OF LENGTH FROM TOP OF FLOORS AT CENTRE IN WAY OF SINGLE BOTTOMS, AND FROM TOP OF MARGIN PLATE IN WAY OF DOUBLE BOTTOMS, TO TOP OF LOWEST TIER OF BEAMS, AT SIDE. *See* SKETCH ON PAGE 21.				
			Feet. Above / not exceeding: 22 and 23	Feet. Above / not exceeding: 23 and 24	Feet. Above / not exceeding: 24 and 25	Feet. Above / not exceeding: 25 and 26	Feet. Above / not exceeding: 26 and 27
			THREE SIDE STRINGERS.				
Feet. Above / not exceeding: 23 and 25	inches. 20	BULB ANGLES.	inches.	inches.	inches.	inches.	inches.
25 „ 27	20						
27 „ 29	$20\frac{1}{2}$						
29 „ 31	$20\frac{1}{2}$						
31 „ 33	21						
33 „ 35	21						
35 „ 37	$21\frac{1}{2}$						
37 „ 39	$21\frac{1}{2}$						
39 „ 42	22						
42 „ 45	22						
45 „ 48	$22\frac{1}{2}$						
48 „ 51	$22\frac{1}{2}$						
51 „ 54	23		$9 \times 3 \times \cdot 50$				
54 „ 57	23		$9 \times 3 \times \cdot 52$	$8\frac{1}{2} \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot 46$ $9\frac{1}{2} \times 3\frac{1}{2} \times \cdot 52$			
57 „ 60	$23\frac{1}{2}$	CHANNELS OR BULB ANGLES.	$8 \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot 46$ $9 \times 3\frac{1}{2} \times \cdot 52$	$8\frac{1}{2} \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot 48$ $9\frac{1}{2} \times 3\frac{1}{2} \times \cdot 54$	$9\frac{1}{2} \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot 48$ $10 \times 3\frac{1}{2} \times \cdot 56$		
60 „ 63	$23\frac{1}{2}$		$8\frac{1}{2} \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot 46$ $9\frac{1}{2} \times 3\frac{1}{2} \times \cdot 52$	$9 \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot 48$ $10 \times 3\frac{1}{2} \times \cdot 54$	$10 \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot 48$ $10\frac{1}{2} \times 3\frac{1}{2} \times \cdot 56$	$11 \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot 48$ $11 \times 3\frac{1}{2} \times \cdot 58$	
63 „ 66	24		$8\frac{1}{2} \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot 48$ $9\frac{1}{2} \times 3\frac{1}{2} \times \cdot 54$	$9\frac{1}{2} \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot 48$ $10 \times 3\frac{1}{2} \times \cdot 56$	$10\frac{1}{2} \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot 48$ $10\frac{1}{2} \times 3\frac{1}{2} \times \cdot 58$	$11 \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot 50$ $11 \times 3\frac{1}{2} \times \cdot 60$	$11\frac{1}{2} \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot 52$ $11\frac{1}{2} \times 3\frac{1}{2} \times \cdot 62$
66 „ 69	24		$9 \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot 48$ $10 \times 3\frac{1}{2} \times \cdot 54$	$10 \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot 48$ $10\frac{1}{2} \times 3\frac{1}{2} \times \cdot 56$	$11 \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot 48$ $11 \times 3\frac{1}{2} \times \cdot 58$	$11\frac{1}{2} \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot 50$ $11\frac{1}{2} \times 3\frac{1}{2} \times \cdot 60$	$12 \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot 52$ $12 \times 3\frac{1}{2} \times \cdot 62$
69 „ 72	$24\frac{1}{2}$		$9\frac{1}{2} \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot 48$ $10 \times 3\frac{1}{2} \times \cdot 56$	$10\frac{1}{2} \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot 48$ $10\frac{1}{2} \times 3\frac{1}{2} \times \cdot 58$	$11 \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot 50$ $11 \times 3\frac{1}{2} \times \cdot 60$	$11\frac{1}{2} \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot 52$ $11\frac{1}{2} \times 3\frac{1}{2} \times \cdot 62$	$12 \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot 56$ $12 \times 3\frac{1}{2} \times \cdot 66$

* The spacing of the frames in the peaks is not to exceed 24 inches where wider spacing is allowed amidships.

FRAMES formed of BULB ANGLES, CHANNELS, or CHANNELS WITH REVERSED FRAMES.

TABLE 3.

(See Continuation.)

TRANSVERSE NUMBER. B + D	Spacing of Frames. *		FRAMES IN PEAKS.		DEPTH (d) AT MIDDLE OF LENGTH, FROM TOP OF FLOORS AT CENTRE IN WAY OF SINGLE BOTTOMS, AND FROM TOP OF MARGIN PLATE IN WAY OF DOUBLE BOTTOMS, TO TOP OF LOWEST TIER OF BEAMS, AT SIDE. *See* SKETCH ON PAGE 21.			
					Feet. Above not exceeding 8 and 9	Feet. Above not exceeding 9 and 10	Feet. Above not exceeding 10 and 11	Feet. Above not exceeding 11 and 12
					<— — — — — — — — — — — — — — — — ONE SIDE STRINGER. — — — — — — — — — — — — — — —

FRAMES formed of BULB ANGLES, CHANNELS, or CHANNELS WITH REVERSED FRAMES.

TABLE 3.

(See Continuation.)

TRANSVERSE NUMBER. B + D	SPACING OF FRAMES.*		DEPTH (d) AT MIDDLE OF LENGTH, FROM TOP OF FLOORS AT CENTRE IN WAY OF SINGLE BOTTOMS, AND FROM TOP OF MARGIN PLATE IN WAY OF DOUBLE BOTTOMS, TO TOP OF LOWEST TIER OF BEAMS, AT SIDE. *See* SKETCH ON PAGE 21.				
			Feet. Above 12 not exceeding 13	Feet. Above 13 not exceeding 14	Feet. Above 14 not exceeding 15	Feet. Above 15 not exceeding 16	Feet. Above 16 not exceeding 17
			ONE SIDE STRINGER.		TWO SIDE STRINGERS.		
Feet. Above 72 not exceeding 75	inches. $24\frac{1}{2}$	BULB ANGLES.	inches. $8 \times 3\frac{1}{2} \times \cdot46$	inches. $8 \times 3\frac{1}{2} \times \cdot48$	inches. $7\frac{1}{2} \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot42$ $8\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$	inches. $7\frac{1}{2} \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot44$ $8\frac{1}{2} \times 3\frac{1}{2} \times \cdot50$	inches. $8 \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot44$ $9 \times 3\frac{1}{2} \times \cdot50$
75 „ 78	25		$8 \times 3\frac{1}{2} \times \cdot48$	$7\frac{1}{2} \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot42$ $8\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$	$7\frac{1}{2} \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot44$ $8\frac{1}{2} \times 3\frac{1}{2} \times \cdot50$	$8 \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot44$ $9 \times 3\frac{1}{2} \times \cdot50$	$8 \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot46$ $9 \times 3\frac{1}{2} \times \cdot52$
78 „ 81	$25\frac{1}{2}$	CHANNELS OR BULB ANGLES.	$7\frac{1}{2} \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot42$ $8\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$	$7\frac{1}{2} \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot44$ $8\frac{1}{2} \times 3\frac{1}{2} \times \cdot50$	$8 \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot44$ $9 \times 3\frac{1}{2} \times \cdot50$	$8 \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot46$ $9 \times 3\frac{1}{2} \times \cdot52$	$8\frac{1}{2} \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot46$ $9\frac{1}{2} \times 3\frac{1}{2} \times \cdot52$
81 „ 84	26		$7\frac{1}{2} \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot44$ $8\frac{1}{2} \times 3\frac{1}{2} \times \cdot50$	$8 \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot44$ $9 \times 3\frac{1}{2} \times \cdot50$	$8 \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot46$ $9 \times 3\frac{1}{2} \times \cdot52$	$8\frac{1}{2} \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot46$ $9\frac{1}{2} \times 3\frac{1}{2} \times \cdot52$	$8\frac{1}{2} \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$ $9\frac{1}{2} \times 3\frac{1}{2} \times \cdot54$
84 „ 87	$26\frac{1}{2}$		$8 \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot44$ $9 \times 3\frac{1}{2} \times \cdot50$	$8 \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot46$ $9 \times 3\frac{1}{2} \times \cdot52$	$8\frac{1}{2} \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot46$ $9\frac{1}{2} \times 3\frac{1}{2} \times \cdot52$	$8\frac{1}{2} \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$ $9\frac{1}{2} \times 3\frac{1}{2} \times \cdot54$	$9 \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$ $10 \times 3\frac{1}{2} \times \cdot54$
87 „ 90	27		$8 \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot46$ $9 \times 3\frac{1}{2} \times \cdot52$	$8\frac{1}{2} \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot46$ $9\frac{1}{2} \times 3\frac{1}{2} \times \cdot52$	$8\frac{1}{2} \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$ $9\frac{1}{2} \times 3\frac{1}{2} \times \cdot54$	$9 \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$ $10 \times 3\frac{1}{2} \times \cdot54$	$9\frac{1}{2} \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$ $10 \times 3\frac{1}{2} \times \cdot56$
90 „ 93	$27\frac{1}{2}$		$8\frac{1}{2} \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$ $9\frac{1}{2} \times 3\frac{1}{2} \times \cdot54$	$8\frac{1}{2} \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$ $9\frac{1}{2} \times 3\frac{1}{2} \times \cdot54$	$9 \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$ $10 \times 3\frac{1}{2} \times \cdot54$	$9\frac{1}{2} \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$ $10 \times 3\frac{1}{2} \times \cdot56$	$10 \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$ $10\frac{1}{2} \times 3\frac{1}{2} \times \cdot56$
93 „ 96	28		$9 \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$ $10 \times 3\frac{1}{2} \times \cdot54$	$9\frac{1}{2} \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$ $10 \times 3\frac{1}{2} \times \cdot56$	$10 \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$ $10\frac{1}{2} \times 3\frac{1}{2} \times \cdot56$	$10\frac{1}{2} \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$ $10\frac{1}{2} \times 3\frac{1}{2} \times \cdot58$	$11 \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$ $11 \times 3\frac{1}{2} \times \cdot58$
96 „ 99	$28\frac{1}{2}$		$10 \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$ $10\frac{1}{2} \times 3\frac{1}{2} \times \cdot56$	$10\frac{1}{2} \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$ $10\frac{1}{2} \times 3\frac{1}{2} \times \cdot58$	$11 \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$ $11 \times 3\frac{1}{2} \times \cdot58$	$11 \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot50$ $11 \times 3\frac{1}{2} \times \cdot60$	$11\frac{1}{2} \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot50$ $11\frac{1}{2} \times 3\frac{1}{2} \times \cdot60$
99 „ 102	29		$11 \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$ $11 \times 3\frac{1}{2} \times \cdot58$	$11 \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot50$ $11 \times 3\frac{1}{2} \times \cdot60$	$11\frac{1}{2} \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot50$ $11\frac{1}{2} \times 3\frac{1}{2} \times \cdot60$	$11\frac{1}{2} \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot52$ $11\frac{1}{2} \times 3\frac{1}{2} \times \cdot62$	$9 \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot46$ $3\frac{1}{2} \times 3\frac{1}{2} \times \cdot46$
102 „ 105	$29\frac{1}{2}$		$11\frac{1}{2} \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot50$ $11\frac{1}{2} \times 3\frac{1}{2} \times \cdot60$	$11\frac{1}{2} \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot52$ $11\frac{1}{2} \times 3\frac{1}{2} \times \cdot62$	$9 \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot46$ $3\frac{1}{2} \times 3\frac{1}{2} \times \cdot46$	$9\frac{1}{2} \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot46$ $3\frac{1}{2} \times 3\frac{1}{2} \times \cdot46$	$9\frac{1}{2} \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$ $3\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$
105 „ 108	30	CHANNELS WITH REVERSED FRAMES EXTENDING TO THE LOWER EDGE OF THE BEAMS OF THE LOWEST DECK.	$9 \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot46$ $3\frac{1}{2} \times 3\frac{1}{2} \times \cdot46$	$9\frac{1}{2} \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot46$ $3\frac{1}{2} \times 3\frac{1}{2} \times \cdot46$	$9\frac{1}{2} \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$ $3\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$	$10 \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$ $3\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$	$10\frac{1}{2} \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$ $3\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$
108 „ 111	$30\frac{1}{2}$		$9\frac{1}{2} \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$ $3\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$	$10 \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$ $3\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$	$10\frac{1}{2} \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$ $3\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$	$11 \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$ $3\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$	$11 \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot50$ $3\frac{1}{2} \times 3\frac{1}{2} \times \cdot50$
111 „ 114	31		$10\frac{1}{2} \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$ $3\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$	$11 \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$ $3\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$	$11 \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot50$ $3\frac{1}{2} \times 3\frac{1}{2} \times \cdot50$	$11\frac{1}{2} \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot50$ $3\frac{1}{2} \times 3\frac{1}{2} \times \cdot50$	$11\frac{1}{2} \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot52$ $3\frac{1}{2} \times 3\frac{1}{2} \times \cdot52$
114 „ 118	$31\frac{1}{2}$		$10 \times 4 \times 4 \times \cdot52$ $4 \times 3\frac{1}{2} \times \cdot52$	$11 \times 4 \times 4 \times \cdot50$ $4 \times 3\frac{1}{2} \times \cdot50$	$11 \times 4 \times 4 \times \cdot52$ $4 \times 3\frac{1}{2} \times \cdot52$	$11 \times 4 \times 4 \times \cdot54$ $4 \times 4 \times \cdot54$	$11 \times 4 \times 4 \times \cdot56$ $4 \times 4 \times \cdot56$
118 „ 122	32		$11 \times 4 \times 4 \times \cdot52$ $4 \times 3\frac{1}{2} \times \cdot52$	$11 \times 4 \times 4 \times \cdot54$ $4 \times 4 \times \cdot54$	$11 \times 4 \times 4 \times \cdot56$ $4 \times 4 \times \cdot56$	$12 \times 4 \times 4 \times \cdot54$ $4 \times 4 \times \cdot54$	
122 „ 126	$32\frac{1}{2}$		$11 \times 4 \times 4 \times \cdot56$ $4 \times 4 \times \cdot56$	$12 \times 4 \times 4 \times \cdot54$ $4 \times 4 \times \cdot54$			
126 „ 130	33						

* The spacing of the frames in the peaks is not to exceed 24 inches where wider spacing is allowed amidships; and from the collision bulkhead to one-fifth the vessel's length from the stem the spacing is not to exceed 27 inches unless the frames are doubled to the height of the lowest tier of beams.

FRAMES formed of BULB ANGLES, CHANNELS, or CHANNELS WITH REVERSED FRAMES.

TABLE 3.

(See Continuation.)

TRANSVERSE NUMBER. B + D	SPACING OF FRAMES.*		DEPTH (d) AT MIDDLE OF LENGTH, FROM TOP OF FLOORS AT CENTRE IN WAY OF SINGLE BOTTOMS, AND FROM TOP OF MARGIN PLATE IN WAY OF DOUBLE BOTTOMS, TO TOP OF LOWEST TIER OF BEAMS, AT SIDE. *See* SKETCH ON PAGE 21.				
			Feet. Above 17 not exceeding 18	Feet. Above 18 not exceeding 19	Feet. Above 19 not exceeding 20	Feet. Above 20 not exceeding 21	Feet. Above 21 not exceeding 22
			← TWO SIDE STRINGERS. →				THREE SIDE STRINGERS.
Feet. Above 72 not exceeding 75	inches. $24\frac{1}{2}$	CHANNELS OR BULB ANGLES.	inches. 8 × $3\frac{1}{2}$ × $3\frac{1}{2}$ × ·44 9 × $3\frac{1}{2}$ × ·50	inches. 8 × $3\frac{1}{2}$ × $3\frac{1}{2}$ × ·46 9 × $3\frac{1}{2}$ × ·52	inches. $8\frac{1}{2}$ × $3\frac{1}{2}$ × $3\frac{1}{2}$ × ·46 $9\frac{1}{2}$ × $3\frac{1}{2}$ × ·52	inches. $8\frac{1}{2}$ × $3\frac{1}{2}$ × $3\frac{1}{2}$ × ·48 $9\frac{1}{2}$ × $3\frac{1}{2}$ × ·54	inches. 9 × $3\frac{1}{2}$ × $3\frac{1}{2}$ × ·48 10 × $3\frac{1}{2}$ × ·54
75 „ 78	25		8 × $3\frac{1}{2}$ × $3\frac{1}{2}$ × ·46 9 × $3\frac{1}{2}$ × ·52	$8\frac{1}{2}$ × $3\frac{1}{2}$ × $3\frac{1}{2}$ × ·46 $9\frac{1}{2}$ × $3\frac{1}{2}$ × ·52	$8\frac{1}{2}$ × $3\frac{1}{2}$ × $3\frac{1}{2}$ × ·48 $9\frac{1}{2}$ × $3\frac{1}{2}$ × ·54	9 × $3\frac{1}{2}$ × $3\frac{1}{2}$ × ·48 10 × $3\frac{1}{2}$ × ·54	$9\frac{1}{2}$ × $3\frac{1}{2}$ × $3\frac{1}{2}$ × ·48 10 × $3\frac{1}{2}$ × ·56
78 „ 81	$25\frac{1}{2}$		$8\frac{1}{2}$ × $3\frac{1}{2}$ × $3\frac{1}{2}$ × ·46 $9\frac{1}{2}$ × $3\frac{1}{2}$ × ·52	$8\frac{1}{2}$ × $3\frac{1}{2}$ × $3\frac{1}{2}$ × ·48 $9\frac{1}{2}$ × $3\frac{1}{2}$ × ·54	9 × $3\frac{1}{2}$ × $3\frac{1}{2}$ × ·48 10 × $3\frac{1}{2}$ × ·54	$9\frac{1}{2}$ × $3\frac{1}{2}$ × $3\frac{1}{2}$ × ·48 10 × $3\frac{1}{2}$ × ·56	10 × $3\frac{1}{2}$ × $3\frac{1}{2}$ × ·48 $10\frac{1}{2}$ × $3\frac{1}{2}$ × ·56
81 „ 84	26		$8\frac{1}{2}$ × $3\frac{1}{2}$ × $3\frac{1}{2}$ × ·48 $9\frac{1}{2}$ × $3\frac{1}{2}$ × ·54	9 × $3\frac{1}{2}$ × $3\frac{1}{2}$ × ·48 10 × $3\frac{1}{2}$ × ·54	$9\frac{1}{2}$ × $3\frac{1}{2}$ × $3\frac{1}{2}$ × ·48 10 × $3\frac{1}{2}$ × ·56	10 × $3\frac{1}{2}$ × $3\frac{1}{2}$ × ·48 $10\frac{1}{2}$ × $3\frac{1}{2}$ × ·56	$10\frac{1}{2}$ × $3\frac{1}{2}$ × $3\frac{1}{2}$ × ·48 $10\frac{1}{2}$ × $3\frac{1}{2}$ × ·58
84 „ 87	$26\frac{1}{2}$		9 × $3\frac{1}{2}$ × $3\frac{1}{2}$ × ·48 10 × $3\frac{1}{2}$ × ·54	$9\frac{1}{2}$ × $3\frac{1}{2}$ × $3\frac{1}{2}$ × ·48 10 × $3\frac{1}{2}$ × ·56	10 × $3\frac{1}{2}$ × $3\frac{1}{2}$ × ·48 $10\frac{1}{2}$ × $3\frac{1}{2}$ × ·56	$10\frac{1}{2}$ × $3\frac{1}{2}$ × $3\frac{1}{2}$ × ·48 $10\frac{1}{2}$ × $3\frac{1}{2}$ × ·58	11 × $3\frac{1}{2}$ × $3\frac{1}{2}$ × ·48 11 × $3\frac{1}{2}$ × ·58
87 „ 90	27		$9\frac{1}{2}$ × $3\frac{1}{2}$ × $3\frac{1}{2}$ × ·48 10 × $3\frac{1}{2}$ × ·56	10 × $3\frac{1}{2}$ × $3\frac{1}{2}$ × ·48 $10\frac{1}{2}$ × $3\frac{1}{2}$ × ·56	$10\frac{1}{2}$ × $3\frac{1}{2}$ × $3\frac{1}{2}$ × ·48 $10\frac{1}{2}$ × $3\frac{1}{2}$ × ·58	11 × $3\frac{1}{2}$ × $3\frac{1}{2}$ × ·48 11 × $3\frac{1}{2}$ × ·58	11 × $3\frac{1}{2}$ × $3\frac{1}{2}$ × ·50 11 × $3\frac{1}{2}$ × ·60
90 „ 93	$27\frac{1}{2}$		$10\frac{1}{2}$ × $3\frac{1}{2}$ × $3\frac{1}{2}$ × ·48 $10\frac{1}{2}$ × $3\frac{1}{2}$ × ·58	11 × $3\frac{1}{2}$ × $3\frac{1}{2}$ × ·48 11 × $3\frac{1}{2}$ × ·58	11 × $3\frac{1}{2}$ × $3\frac{1}{2}$ × ·50 11 × $3\frac{1}{2}$ × ·60	$11\frac{1}{2}$ × $3\frac{1}{2}$ × $3\frac{1}{2}$ × ·50 $11\frac{1}{2}$ × $3\frac{1}{2}$ × ·60	$11\frac{1}{2}$ × $3\frac{1}{2}$ × $3\frac{1}{2}$ × ·52 $11\frac{1}{2}$ × $3\frac{1}{2}$ × ·62
93 „ 96	28		11 × $3\frac{1}{2}$ × $3\frac{1}{2}$ × ·50 11 × $3\frac{1}{2}$ × ·60	$11\frac{1}{2}$ × $3\frac{1}{2}$ × $3\frac{1}{2}$ × ·50 $11\frac{1}{2}$ × $3\frac{1}{2}$ × ·60	$11\frac{1}{2}$ × $3\frac{1}{2}$ × $3\frac{1}{2}$ × ·52 $11\frac{1}{2}$ × $3\frac{1}{2}$ × ·62	9 × $3\frac{1}{2}$ × $3\frac{1}{2}$ × ·46 $3\frac{1}{2}$ × $3\frac{1}{2}$ × ·46	$9\frac{1}{2}$ × $3\frac{1}{2}$ × $3\frac{1}{2}$ × ·46 $3\frac{1}{2}$ × $3\frac{1}{2}$ × ·46
96 „ 99	$28\frac{1}{2}$		$11\frac{1}{2}$ × $3\frac{1}{2}$ × $3\frac{1}{2}$ × ·52 $11\frac{1}{2}$ × $3\frac{1}{2}$ × ·62	9 × $3\frac{1}{2}$ × $3\frac{1}{2}$ × ·46 $3\frac{1}{2}$ × $3\frac{1}{2}$ × ·46	$9\frac{1}{2}$ × $3\frac{1}{2}$ × $3\frac{1}{2}$ × ·46 $3\frac{1}{2}$ × $3\frac{1}{2}$ × ·46	$9\frac{1}{2}$ × $3\frac{1}{2}$ × $3\frac{1}{2}$ × ·48 $3\frac{1}{2}$ × $3\frac{1}{2}$ × ·48	10 × $3\frac{1}{2}$ × $3\frac{1}{2}$ × ·48 $3\frac{1}{2}$ × $3\frac{1}{2}$ × ·48
99 „ 102	29	CHANNELS WITH REVERSED FRAMES EXTENDING TO THE LOWER EDGE OF THE BEAMS OF THE LOWEST DECK.	$9\frac{1}{2}$ × $3\frac{1}{2}$ × $3\frac{1}{2}$ × ·46 $3\frac{1}{2}$ × $3\frac{1}{2}$ × ·46	$9\frac{1}{2}$ × $3\frac{1}{2}$ × $3\frac{1}{2}$ × ·48 $3\frac{1}{2}$ × $3\frac{1}{2}$ × ·48	10 × $3\frac{1}{2}$ × $3\frac{1}{2}$ × ·48 $3\frac{1}{2}$ × $3\frac{1}{2}$ × ·48	$10\frac{1}{2}$ × $3\frac{1}{2}$ × $3\frac{1}{2}$ × ·48 $3\frac{1}{2}$ × $3\frac{1}{2}$ × ·48	11 × $3\frac{1}{2}$ × $3\frac{1}{2}$ × ·48 $3\frac{1}{2}$ × $3\frac{1}{2}$ × ·48
102 „ 105	$29\frac{1}{2}$		10 × $3\frac{1}{2}$ × $3\frac{1}{2}$ × ·48 $3\frac{1}{2}$ × $3\frac{1}{2}$ × ·48	$10\frac{1}{2}$ × $3\frac{1}{2}$ × $3\frac{1}{2}$ × ·48 $3\frac{1}{2}$ × $3\frac{1}{2}$ × ·48	11 × $3\frac{1}{2}$ × $3\frac{1}{2}$ × ·48 $3\frac{1}{2}$ × $3\frac{1}{2}$ × ·48	11 × $3\frac{1}{2}$ × $3\frac{1}{2}$ × ·50 $3\frac{1}{2}$ × $3\frac{1}{2}$ × ·50	$11\frac{1}{2}$ × $3\frac{1}{2}$ × $3\frac{1}{2}$ × ·50 $3\frac{1}{2}$ × $3\frac{1}{2}$ × ·50
105 „ 108	30		11 × $3\frac{1}{2}$ × $3\frac{1}{2}$ × ·48 $3\frac{1}{2}$ × $3\frac{1}{2}$ × ·48	11 × $3\frac{1}{2}$ × $3\frac{1}{2}$ × ·50 $3\frac{1}{2}$ × $3\frac{1}{2}$ × ·50	$11\frac{1}{2}$ × $3\frac{1}{2}$ × $3\frac{1}{2}$ × ·50 $3\frac{1}{2}$ × $3\frac{1}{2}$ × ·50	$11\frac{1}{2}$ × $3\frac{1}{2}$ × $3\frac{1}{2}$ × ·52 $3\frac{1}{2}$ × $3\frac{1}{2}$ × ·52	12 × $3\frac{1}{2}$ × $3\frac{1}{2}$ × ·52 $3\frac{1}{2}$ × $3\frac{1}{2}$ × ·52
108 „ 111	$30\frac{1}{2}$		$11\frac{1}{2}$ × $3\frac{1}{2}$ × $3\frac{1}{2}$ × ·50 $3\frac{1}{2}$ × $3\frac{1}{2}$ × ·50	$11\frac{1}{2}$ × $3\frac{1}{2}$ × $3\frac{1}{2}$ × ·52 $3\frac{1}{2}$ × $3\frac{1}{2}$ × ·52	12 × $3\frac{1}{2}$ × $3\frac{1}{2}$ × ·52 $3\frac{1}{2}$ × $3\frac{1}{2}$ × ·52	12 × $3\frac{1}{2}$ × $3\frac{1}{2}$ × ·56 $3\frac{1}{2}$ × $3\frac{1}{2}$ × ·56	
111 „ 114	31		12 × $3\frac{1}{2}$ × $3\frac{1}{2}$ × ·52 $3\frac{1}{2}$ × $3\frac{1}{2}$ × ·52	12 × $3\frac{1}{2}$ × $3\frac{1}{2}$ × ·56 $3\frac{1}{2}$ × $3\frac{1}{2}$ × ·56			
114 „ 118	$31\frac{1}{2}$		12 × 4 × 4 × ·54 4 × 4 × ·54				
118 „ 122	32						
122 „ 126	$32\frac{1}{2}$						
126 „ 130	33						

* The spacing of the frames in the peaks is not to exceed 24 inches where wider spacing is allowed amidships; and from the collision bulkhead to one-fifth the vessel's length from the stem the spacing is not to exceed 27 inches unless the frames are doubled to the height of the lowest tier of beams.

FRAMES formed of BULB ANGLES, CHANNELS, or CHANNELS WITH REVERSED FRAMES. TABLE 3. *(Concluded.)*

TRANSVERSE NUMBER. B + D	SPACING OF FRAMES.*		DEPTH (d) AT MIDDLE OF LENGTH FROM TOP OF FLOORS AT CENTRE IN WAY OF SINGLE BOTTOMS, AND FROM TOP OF MARGIN PLATE IN WAY OF DOUBLE BOTTOMS, TO TOP OF LOWEST TIER OF BEAMS, AT SIDE. *See* SKETCH ON PAGE 21.				
			Feet. Above / not exceeding 22 and 23	Feet. Above / not exceeding 23 and 24	Feet. Above / not exceeding 24 and 25	Feet. Above / not exceeding 25 and 26	Feet. Above / not exceeding 26 and 27
			THREE SIDE STRINGERS.				
Feet. Above / not exceeding 72 and 75	inches. $24\frac{1}{2}$	CHANNELS OR BULB ANGLES	inches. $10 \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$ / $10\frac{1}{2} \times 3\frac{1}{2} \times \cdot56$	inches. $11 \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$ / $11 \times 3\frac{1}{2} \times \cdot58$	inches. $11\frac{1}{2} \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot50$ / $11\frac{1}{2} \times 3\frac{1}{2} \times \cdot60$	inches. $12 \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot52$ / $12 \times 3\frac{1}{2} \times \cdot62$	inches. $9\frac{1}{2} \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$ / $3\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$
75 „ 78	25		$10\frac{1}{2} \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$ / $10\frac{1}{2} \times 3\frac{1}{2} \times \cdot58$	$11 \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot50$ / $11 \times 3\frac{1}{2} \times \cdot60$	$11\frac{1}{2} \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot52$ / $11\frac{1}{2} \times 3\frac{1}{2} \times \cdot62$	$12 \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot56$ / $12 \times 3\frac{1}{2} \times \cdot66$	$10 \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$ / $3\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$
78 „ 81	$25\frac{1}{2}$		$11 \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$ / $11 \times 3\frac{1}{2} \times \cdot58$	$11\frac{1}{2} \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot50$ / $11\frac{1}{2} \times 3\frac{1}{2} \times \cdot60$	$12 \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot52$ / $12 \times 3\frac{1}{2} \times \cdot62$	$9\frac{1}{2} \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$ / $3\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$	$10\frac{1}{2} \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$ / $3\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$
81 „ 84	26		$11 \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot50$ / $11 \times 3\frac{1}{2} \times \cdot60$	$11\frac{1}{2} \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot52$ / $11\frac{1}{2} \times 3\frac{1}{2} \times \cdot62$	$12 \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot56$ / $12 \times 3\frac{1}{2} \times \cdot66$	$10 \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$ / $3\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$	$11 \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$ / $3\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$
84 „ 87	$26\frac{1}{2}$		$11\frac{1}{2} \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot50$ / $11\frac{1}{2} \times 3\frac{1}{2} \times \cdot60$	$9 \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot46$ / $3\frac{1}{2} \times 3\frac{1}{2} \times \cdot46$	$9\frac{1}{2} \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$ / $3\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$	$10\frac{1}{2} \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$ / $3\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$	$11 \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot50$ / $3\frac{1}{2} \times 3\frac{1}{2} \times \cdot50$
87 „ 90	27		$11\frac{1}{2} \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot52$ / $11\frac{1}{2} \times 3\frac{1}{2} \times \cdot62$	$9\frac{1}{2} \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot46$ / $3\frac{1}{2} \times 3\frac{1}{2} \times \cdot46$	$10 \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$ / $3\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$	$11 \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$ / $3\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$	$11\frac{1}{2} \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot50$ / $3\frac{1}{2} \times 3\frac{1}{2} \times \cdot50$
90 „ 93	$27\frac{1}{2}$	CHANNELS WITH REVERSED FRAMES EXTENDING TO THE LOWER EDGE OF THE BEAMS OF THE LOWEST DECK.	$9\frac{1}{2} \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot46$ / $3\frac{1}{2} \times 3\frac{1}{2} \times \cdot46$	$10 \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$ / $3\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$	$11 \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$ / $3\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$	$11\frac{1}{2} \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot50$ / $3\frac{1}{2} \times 3\frac{1}{2} \times \cdot50$	$12 \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot52$ / $3\frac{1}{2} \times 3\frac{1}{2} \times \cdot52$
93 „ 96	28		$10 \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$ / $3\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$	$11 \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$ / $3\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$	$11\frac{1}{2} \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot50$ / $3\frac{1}{2} \times 3\frac{1}{2} \times \cdot50$	$12 \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot52$ / $3\frac{1}{2} \times 3\frac{1}{2} \times \cdot52$	
96 „ 99	$28\frac{1}{2}$		$11 \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$ / $3\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$	$11\frac{1}{2} \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot50$ / $3\frac{1}{2} \times 3\frac{1}{2} \times \cdot50$	$12 \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot52$ / $3\frac{1}{2} \times 3\frac{1}{2} \times \cdot52$		
99 „ 102	29		$11\frac{1}{2} \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot50$ / $3\frac{1}{2} \times 3\frac{1}{2} \times \cdot50$	$12 \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot52$ / $3\frac{1}{2} \times 3\frac{1}{2} \times \cdot52$			
102 „ 105	$29\frac{1}{2}$		$12 \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot52$ / $3\frac{1}{2} \times 3\frac{1}{2} \times \cdot52$				
105 „ 108	30						
108 „ 111	$30\frac{1}{2}$						
111 „ 114	31						
114 „ 118	$31\frac{1}{2}$						
118 „ 122	32						
122 „ 126	$32\frac{1}{2}$						
126 „ 130	33						

*The spacing of the frames in the peaks is not to exceed 24 inches where wider spacing is allowed amidships; and from the collision bulkhead to one-fifth the vessel's length from the stem the spacing is not to exceed 27 inches unless the frames are doubled to the height of the lowest tier of beams.

FLOOR PLATES IN VESSELS WITH SINGLE BOTTOMS. TABLE 4.

TRANSVERSE NUMBER. B + D	DEPTH AT CENTRE.	THICKNESS.*	
		For $\frac{3}{5}$ length Amidships.	At Ends of Vessel.
Above Feet and not exceeding	inches.	inches.	inches.
Above 23 and 24	$8\frac{1}{2}$	·22	·22
24 „ 25	$8\frac{1}{2}$	·24	·24
25 „ 26	9	·24	·24
26 „ 27	$9\frac{1}{2}$	·24	·24
27 „ 28	10	·24	·24
28 „ 29	10	·26	·24
29 „ 30	$10\frac{1}{2}$	·26	·24
30 „ 31	11	·26	·24
31 „ 32	$11\frac{1}{2}$	·26	·24
32 „ 33	$11\frac{1}{2}$	·28	·26
33 „ 34	12	·28	·26
34 „ 35	$12\frac{1}{2}$	·28	·26
35 „ 36	13	·28	·26
36 „ 37	13	·30	·26
37 „ 38	$13\frac{1}{2}$	·30	·26
38 „ 39	14	·30	·26
39 „ 40	$14\frac{1}{2}$	·30	·26
40 „ 41	$14\frac{1}{2}$	·32	·28
41 „ 42	15	·32	·28
42 „ 43	$15\frac{1}{2}$	·32	·28
43 „ 44	16	·32	·28
44 „ 45	16	·34	·30
45 „ 46	17	·34	·30
46 „ 47	18	·34	·30
47 „ 48	18	·36	·32

TRANSVERSE NUMBER. B + D	DEPTH AT CENTRE.	THICKNESS.*	
		For $\frac{3}{5}$ length Amidships.	At Ends of Vessel.
Above Feet. and not exceeding	inches.	inches.	inches.
Above 48 and 49	19	·36	·32
49 „ 50	20	·36	·32
50 „ 51	20	·38	·34
51 „ 52	21	·38	·34
52 „ 53	22	·38	·34
53 „ 54	22	·40	·34
54 „ 55	23	·40	·34
55 „ 56	24	·40	·34
56 „ 58	24	·42	·36
58 „ 60	25	·42	·36
60 „ 62	26	·42	·36
62 „ 64	26	·44	·36
64 „ 66	27	·44	·36
66 „ 68	28	·44	·36
68 „ 70	28	·46	·38
70 „ 72	29	·46	·38
72 „ 74	30	·46	·38
74 „ 76	30	·48	·38
76 „ 78	31	·48	·38
78 „ 80	32	·48	·38
80 „ 82	32	·50	·40
82 „ 84	33	·50	·40
84 „ 86	34	·50	·40
86 „ 88	35	·50	·40

* In the engine space of steam vessels the floors are to be ·04 of an inch thicker, and in the boiler space ·10 of an inch thicker than required by the Table.

LLOYD'S REGISTER OF SHIPPING, LONDON—*11th May, 1911.*

WEB FRAMES and STRINGERS.

TABLE 5.

(See Continuation.)

DEPTH (d) AT MIDDLE OF LENGTH FROM TOP OF FLOORS AT CENTRE IN WAY OF SINGLE BOTTOMS, AND FROM TOP OF MARGIN PLATE IN WAY OF DOUBLE BOTTOMS, TO TOP OF BEAMS AT SIDE OF LOWEST LAID DECK.

TRANSVERSE NUMBER. B + D. Feet.	Feet. Above 14 and not exceeding 15	Feet. Above 15 and not exceeding 16	Feet. Above 16 and not exceeding 17	Feet. Above 17 and not exceeding 18	Feet. Above 18 and not exceeding 19	Feet. Above 19 and not exceeding 20	Feet. Above 20 and not exceeding 21	Feet. Above 21 and not exceeding 22	Feet. Above 22 and not exceeding 23	Feet. Above 23 and not exceeding 24	Feet. Above 24 and not exceeding 25	Feet. Above 25 and not exceeding 26	Feet. Above 26 and not exceeding 27	THICKNESS OF STRINGER PLATES.
	ONE SIDE STRINGER.	< TWO SIDE STRINGERS. >									< THREE SIDE STRINGERS. >			
Above ... not exceeding	inches.	inches.	inches.	inches.	inches.	inches.	inches.	inches.	inches.	inches.	inches.	inches.	inches.	ins.
48 and 51	14 × ·30	14 × ·32	14 × ·34	14 × ·36	15 × ·36									·30
51 „ 54	14 × ·32	14 × ·34	14 × ·36	15 × ·36	16 × ·36	16 × ·38								·30
54 „ 57	14 × ·34	14 × ·36	15 × ·36	16 × ·36	16 × ·38	17 × ·38	18 × ·38							·30
57 „ 60	14 × ·36	15 × ·36	16 × ·36	16 × ·38	17 × ·38	18 × ·38	18 × ·40	19 × ·40	20 × ·42					·30
60 „ 63	15 × ·36	16 × ·36	16 × ·38	17 × ·38	18 × ·38	18 × ·40	19 × ·40	20 × ·40	21 × ·42	22 × ·44	24 × ·44			·32
63 „ 66	16 × ·36	16 × ·38	17 × ·38	18 × ·38	18 × ·40	19 × ·40	20 × ·40	21 × ·40	22 × ·42	23 × ·44	24 × ·46	26 × ·46	27 × ·48	·32
66 „ 69	16 × ·38	17 × ·38	18 × ·38	18 × ·40	19 × ·40	20 × ·40	20 × ·42	21 × ·42	22 × ·44	24 × ·44	25 × ·46	26 × ·48	28 × ·48	·34
69 „ 72	17 × ·38	18 × ·38	18 × ·40	19 × ·40	20 × ·40	20 × ·42	21 × ·42	22 × ·42	23 × ·44	24 × ·46	26 × ·46	27 × ·48	28 × ·50	·34
72 „ 75	18 × ·38	18 × ·40	19 × ·40	20 × ·40	20 × ·42	21 × ·42	22 × ·42	23 × ·42	24 × ·44	25 × ·46	26 × ·48	28 × ·48	29 × ·50	·34
75 „ 78	18 × ·40	19 × ·40	20 × ·40	20 × ·42	21 × ·42	22 × ·42	22 × ·44	23 × ·44	24 × ·46	26 × ·46	27 × ·48	28 × ·50	30 × ·50	·36
78 „ 81	19 × ·40	20 × ·40	20 × ·42	21 × ·42	22 × ·42	22 × ·44	23 × ·44	24 × ·44	25 × ·46	26 × ·48	28 × ·48	29 × ·50	30 × ·52	·36
81 „ 84	20 × ·40	20 × ·42	21 × ·42	22 × ·42	22 × ·44	23 × ·44	24 × ·44	25 × ·44	26 × ·46	27 × ·48	28 × ·50	30 × ·50	31 × ·52	·38
84 „ 87	20 × ·42	21 × ·42	22 × ·42	22 × ·44	23 × ·44	24 × ·44	24 × ·46	25 × ·46	26 × ·48	28 × ·48	29 × ·50	30 × ·52	32 × ·52	·38
87 „ 90	21 × ·42	22 × ·42	22 × ·44	23 × ·44	24 × ·44	24 × ·46	25 × ·46	26 × ·46	27 × ·48	28 × ·50	30 × ·50	31 × ·52	32 × ·54	·40
90 „ 93	22 × ·44	23 × ·44	24 × ·44	24 × ·46	25 × ·46	26 × ·46	26 × ·48	27 × ·48	28 × ·50	30 × ·50	31 × ·52	32 × ·54	34 × ·54	·40
93 „ 96	24 × ·44	24 × ·46	25 × ·46	26 × ·46	26 × ·48	27 × ·48	28 × ·48	29 × ·48	30 × ·50	31 × ·52	32 × ·54	34 × ·54	35 × ·56	·42
96 „ 99	25 × ·46	26 × ·46	26 × ·48	27 × ·48	28 × ·48	28 × ·50	29 × ·50	30 × ·50	31 × ·52	32 × ·54	34 × ·54	35 × ·56	36 × ·58	·42
99 „ 102	26 × ·48	27 × ·48	28 × ·48	28 × ·50	29 × ·50	30 × ·50	30 × ·52	31 × ·52	32 × ·54	34 × ·54	35 × ·56	36 × ·58	38 × ·58	·44
102 „ 105	28 × ·48	28 × ·50	29 × ·50	30 × ·50	30 × ·52	31 × ·52	32 × ·52	33 × ·52	34 × ·54	35 × ·56	36 × ·58	38 × ·58	39 × ·60	·44
105 „ 108	29 × ·50	30 × ·50	30 × ·52	31 × ·52	32 × ·52	32 × ·54	33 × ·54	34 × ·54	35 × ·56	36 × ·58	38 × ·58	39 × ·60	40 × ·62	·46
108 „ 111	30 × ·52	31 × ·52	32 × ·52	32 × ·54	33 × ·54	34 × ·54	34 × ·56	35 × ·56	36 × ·58	38 × ·58	39 × ·60	40 × ·62	42 × ·62	·46
111 „ 114	32 × ·52	32 × ·54	33 × ·54	34 × ·54	34 × ·56	35 × ·56	36 × ·56	37 × ·56	38 × ·58	39 × ·60	40 × ·62	42 × ·62		·48
114 „ 118	33 × ·54	34 × ·54	34 × ·56	35 × ·56	36 × ·56	36 × ·58	37 × ·58	38 × ·58	39 × ·60	40 × ·62	42 × ·62			·48
118 „ 122	34 × ·56	35 × ·56	36 × ·56	36 × ·58	37 × ·58	38 × ·58	38 × ·60	39 × ·60	40 × ·62	42 × ·62				·50
122 „ 126	36 × ·56	36 × ·58	37 × ·58	38 × ·58	38 × ·60	39 × ·60	40 × ·60	41 × ·60	42 × ·62					·50
126 „ 130	37 × ·58	38 × ·58	38 × ·60	39 × ·60	39 × ·62	40 × ·62	41 × ·62	42 × ·62						·52

INTERMEDIATE FRAMES, FACE ANGLES, &c. TABLE 5

(Concluded.)

TRANSVERSE NUMBER. Feet. Above	and not exceeding	FRAME SPACING.* ins.	INTERMEDIATE FRAMES. Built Framing. Frames. inches.	Reversed Frames. inches.	Bulb Angles. inches.	Channels. inches.	FACE ANGLES. Double on Web Frames, Single on Stringers. inches.	Single on Web Frames. inches.	BUTT STRAPS FOR STRINGER FACE ANGLES. Dimensions. Length. ins.	Breadth. ins.	Thickness. ins.	Rivets. Number in Straps and Stringer Face Angles	Number in Straps and
48 and	51	22½	3½ × 3 × ·30	3 × 2½ × ·30			3 × 3 × ·30	5 × 3 × ·48	42	6	·46	10	2
51 „	54	23	3½ × 3 × ·30	3 × 3 × ·30			3 × 3 × ·32	5 × 3 × ·50	„	„	„	„	„
54 „	57	23	4 × 3 × ·30	3 × 3 × ·30			3 × 3 × ·34	5 × 3 × ·52	„	„	·48	„	„
57 „	60	23½	4½ × 3 × ·30	3 × 3 × ·30	5½ × 3 × ·36		3 × 3 × ·36	5 × 3½ × ·52	„	„	„	„	„
60 „	63	23½	4½ × 3 × ·32	3 × 3 × ·32	5½ × 3 × ·38		3½ × 3 × ·36	5 × 3½ × ·54	„	„	·50	„	„
63 „	66	24	5 × 3 × ·32	3 × 3 × ·32	6 × 3 × ·38		3½ × 3 × ·38	6 × 3½ × ·54	„	„	„	„	„
66 „	69	24	5 × 3 × ·34	3 × 3 × ·34	6 × 3 × ·40		3½ × 3 × ·40	6 × 3½ × ·56	„	„	·52	„	„
69 „	72	24½	5½ × 3½ × ·34	3 × 3 × ·34	6½ × 3½ × ·40		3½ × 3½ × ·40	6½ × 3½ × ·58	48	7	„	12	4
72 „	75	24½	5½ × 3½ × ·34	3½ × 3 × ·34	6½ × 3½ × ·40		3½ × 3½ × ·42	6½ × 3½ × ·60	„	„	·54	„	„
75 „	78	25	5½ × 3½ × ·36	3½ × 3 × ·36	6½ × 3½ × ·42		3½ × 3½ × ·44	7 × 3½ × ·60	„	„	„	„	„
78 „	81	25½	6 × 3½ × ·36	3½ × 3 × ·36	7 × 3½ × ·42		3½ × 3½ × ·46	7 × 3½ × ·62	„	„	·56	„	„
81 „	84	26	6 × 3½ × ·38	3½ × 3 × ·38	7 × 3½ × ·44		3½ × 3½ × ·48	7 × 3½ × ·64	„	„	„	„	„
84 „	87	26½	6½ × 3½ × ·38	3½ × 3 × ·38	7½ × 3½ × ·44		3½ × 3½ × ·50	7 × 3½ × ·66	„	„	·58	„	„
87 „	90	27	6½ × 3½ × ·40	3½ × 3 × ·40	7½ × 3½ × ·46		3½ × 3½ × ·52	7 × 3½ × ·68	„	„	„	„	„
90 „	93	27½	7 × 3½ × ·40	3½ × 3 × ·40	8 × 3½ × ·46		4 × 3½ × ·52		54	8	·60	„	„
93 „	96	28	7 × 3½ × ·42	3½ × 3 × ·42	8 × 3½ × ·48	7 × 3½ × 3½ × ·42	4 × 3½ × ·54		„	„	„	„	„
96 „	99	28½	7 × 3½ × ·42	3½ × 3½ × ·42	8½ × 3½ × ·48	7½ × 3½ × 3½ × ·42	4 × 3½ × ·56		„	„	·62	„	„
99 „	102	29	7 × 3½ × ·44	3½ × 3½ × ·44	8½ × 3½ × ·50	7½ × 3½ × 3½ × ·44	4 × 3½ × ·58		„	„	„	„	„
102 „	105	29½	7 × 3½ × ·44	4 × 3½ × ·44	9 × 3½ × ·50	8 × 3½ × 3½ × ·44	4 × 4 × ·58		„	„	·64	„	„
105 „	108	30	7 × 3½ × ·46	4 × 3½ × ·46	9 × 3½ × ·52	8 × 3½ × 3½ × ·46	4 × 4 × ·60		„	„	„	„	„
108 „	111	30½			9½ × 3½ × ·52	8½ × 3½ × 3½ × ·46	4 × 4 × ·62		„	„	·66	„	„
111 „	114	31			9½ × 3½ × ·54	8½ × 3½ × 3½ × ·48	4 × 4 × ·64		60	12	„	14	6
114 „	118	31½				9 × 4 × 4 × ·48	4½ × 4½ × ·64		„	„	·68	„	„
118 „	122	32				9 × 4 × 4 × ·52	4½ × 4½ × ·66		„	„	„	„	„
122 „	126	32½				10 × 4 × 4 × ·52	4½ × 4½ × ·68		„	„	·70	„	„
126 „	130	33				10 × 4 × 4 × ·56	4½ × 4½ × ·70		„	„	„	„	„

* From the collision bulkhead to one-fifth the vessel's length from stem the spacing of the frames is not to exceed 27 inches when wider spacing is allowed amidships.

MIDDLE LINE KEELSONS in VESSELS with SINGLE BOTTOMS. TABLE 6.

(See Continuation.)

LONGITUDINAL NUMBER. L × (B + D)	KEELSON ANGLES.		MIDDLE LINE KEELSONS.							
			Ordinary Keelsons standing upon floors.*		Keelsons with Intercostal Plates.				Keelsons with Centre Through Plate.**	
							Intercostal Plate.			Thickness of centre through plate and foundation plates.
	For ½ length Amidships.	Thickness at Ends.	For ½ length Amidships.	Thickness at Ends.	For ½ length Amidships.	Thickness at Ends.	For ½ length Amidships.	Thickness at Ends.	Double Angles.	For ½ length Amidships. / At Ends.
Above / not exceeding	inches.	inches.	inches.	inches.	inches.	inches.	inches.	inches.	inches.	inches. / inches.
			Double Bulb Angles.		Double Angles.					
1200 and 1400	3 × 3 × ·24	·24	6½ × 3 × ·38	·38	3 × 3 × ·30	·30	·26	·26	3 × 3 × ·24	·26 / ·26
1400 „ 1700	3 × 3 × ·24	·24	7 × 3 × ·40	·40	3½ × 3 × ·30	·30	·26	·26	3 × 3 × ·24	·26 / ·26
1700 „ 2000	3 × 3 × ·24	·24	7½ × 3 × ·42	·42	3½ × 3 × ·32	·32	·28	·26	3 × 3 × ·24	·28 / ·26
2000 „ 2400	3 × 3 × ·24	·24	8 × 3 × ·44	·44	3½ × 3½ × ·32	·32	·28	·26	3 × 3 × ·24	·28 / ·26
2400 „ 2800	3 × 3 × ·26	·26	8 × 3½ × ·46	·46	3½ × 3½ × ·34	·34	·30	·26	3 × 3 × ·26	·30 / ·26
2800 „ 3200	3 × 3 × ·26	·26	8 × 3½ × ·48	·48	4 × 3½ × ·34	·34	·30	·26	3 × 3 × ·26	·30 / ·26
3200 „ 3700	3 × 3 × ·28	·28	8½ × 3½ × ·48	·48	4 × 3½ × ·36	·36	·30	·26	3 × 3 × ·28	·30 / ·26
3700 „ 4200	3 × 3 × ·28	·28	9 × 3½ × ·48	·48	4½ × 3½ × ·36	·36	·32	·28	3 × 3 × ·28	·32 / ·28
4200 „ 4700	3 × 3 × ·30	·30	9 × 3½ × ·50	·50	4½ × 3½ × ·38	·38	·32	·28	3 × 3 × ·30	·32 / ·28
			Plate, Four Angles & Rider	Plate.†	Double Bulb Angles.					
4700 „ 5200	3 × 3 × ·30	·30	11 × ·42	·34	5½ × 3 × ·36	·36	·32	·28	3 × 3 × ·30	·32 / ·28
5200 „ 5800	3½ × 3 × ·30	·30	11 × ·44	·38	5½ × 3 × ·38	·38	·34	·30	3½ × 3 × ·30	·34 / ·30
5800 „ 6400	3½ × 3 × ·32	·32	12 × ·44	·38	5½ × 3 × ·40	·40	·34	·30	3½ × 3 × ·32	·34 / ·30
6400 „ 7000	3½ × 3 × ·32	·32	12 × ·46	·38	6 × 3 × ·40	·40	·34	·30	3½ × 3 × ·32	·34 / ·30
7000 „ 7600	3½ × 3 × ·34	·34	13 × ·46	·38	6½ × 3 × ·40	·40	·36	·32	3½ × 3 × ·34	·36 / ·32
7600 „ 8200	4 × 3 × ·34	·34	13 × ·48	·40	7 × 3 × ·40	·40	·36	·32	4 × 3 × ·34	·36 / ·32
8200 „ 8800	4 × 3 × ·34	·34	14 × ·48	·40	7½ × 3 × ·42	·42	·36	·32	4 × 3 × ·34	·36 / ·32
8800 „ 9400	4 × 3 × ·36	·34	14 × ·50	·40	8 × 3 × ·44	·44	·38	·34	4 × 3 × ·36	·38 / ·34
9400 „ 10000	4 × 3 × ·36	·34	15 × ·50	·40	8 × 3½ × ·46	·46	·38	·34	4 × 3 × ·36	·38 / ·34
									Double Bulb Angles.	
10000 „ 10600	4½ × 3 × ·36	·34	15 × ·52	·42	8 × 3½ × ·48	·48	·38	·34	5½ × 3 × ·38	·38 / ·34
10600 „ 11200	4½ × 3½ × ·36	·34	16 × ·52	·42	8½ × 3½ × ·48	·48	·40	·36	5½ × 3 × ·40	·40 / ·36
11200 „ 11800	4½ × 3½ × ·36	·34	16 × ·54	·44	9 × 3½ × ·48	·48	·40	·36	6 × 3 × ·40	·40 / ·36
11800 „ 12400	5 × 3½ × ·36	·34	17 × ·54	·44	9 × 3½ × ·50	·50	·40	·36	6½ × 3 × ·40	·40 / ·36
					Plate, Four Angles & Rider	Plate.†				
12400 „ 13000	5 × 3½ × ·38	·36	17 × ·56	·46	10 × ·56	·46	·42	·38	7 × 3 × ·40	·42 / ·38
13000 „ 13600	5 × 3½ × ·40	·36	18 × ·56	·46	11 × ·56	·46	·42	·38	7½ × 3 × ·42	·42 / ·38
13600 „ 14200	5 × 3½ × ·40	·36	18 × ·58	·48	11 × ·58	·48	·42	·38	8 × 3 × ·44	·42 / ·38
14200 „ 14800	5½ × 3½ × ·40	·36	19 × ·58	·48	12 × ·58	·48	·44	·38	8 × 3½ × ·46	·44 / ·38
14800 „ 15400	5½ × 3½ × ·40	·36	19 × ·60	·50	12 × ·60	·50	·44	·38	8 × 3½ × ·48	·44 / ·38
15400 „ 16000	5½ × 3½ × ·42	·36	20 × ·60	·50	13 × ·60	·50	·44	·38	8½ × 3½ × ·48	·44 / ·38
16000 „ 16600	6 × 3½ × ·42	·36	20 × ·62	·52	13 × ·62	·52	·46	·40	9 × 3½ × ·48	·46 / ·40
16600 „ 17200	6 × 3½ × ·42	·36	21 × ·62	·52	14 × ·62	·52	·46	·40	9 × 3½ × ·50	·46 / ·40
									Plate, Four Angles and Rider Plate.†	
17200 „ 18000	6 × 3½ × ·44	·38	21 × ·64	·54	14 × ·64	·54	·46	·40	11	·46 / ·40
18000 „ 19000	6 × 3½ × ·44	·38	22 × ·64	·54	15 × ·64	·54	·46	·40	12	·46 / ·40
19000 „ 20000	6 × 3½ × ·44	·38	22 × ·66	·56	15 × ·66	·56	·46	·40	12	·46 / ·40
20000 „ 21000	6½ × 3½ × ·44	·38	23 × ·66	·56	16 × ·66	·56	·48	·40	13	·48 / ·40
21000 „ 22000	6½ × 3½ × ·44	·38	23 × ·68	·58	16 × ·68	·58	·48	·42	13	·48 / ·42
22000 „ 24000	6½ × 3½ × ·46	·38	24 × ·68	·58	17 × ·68	·58	·48	·42	14	·48 / ·42
24000 „ 26000	6½ × 3½ × ·46	·38	24 × ·70	·60	17 × ·70	·60	·48	·42	14	·48 / ·42
			Plate, Four Angles, Rider and Foundation Plate.††							
26000 „ 28000	6½ × 3½ × ·48	·38	25 × ·70	·60	18 × ·70	·60	·50	·42	15	·50 / ·42
28000 „ 30000	6½ × 3½ × ·48	·38	26 × ·70	·60	19 × ·70	·60	·50	·42	16	·50 / ·42
30000 „ 32000	6½ × 3½ × ·50	·40	26 × ·72	·62	19 × ·72	·62	·50	·42	16	·50 / ·42
32000 „ 34000	6½ × 3½ × ·50	·40	27 × ·72	·62	20 × ·72	·62	·50	·42	17	·50 / ·42
34000 „ 36000	7 × 3½ × ·50	·40	28 × ·72	·62	21 × ·72	·62	·52	·44	18	·52 / ·44

KEEL ANGLES and SIDE KEELSONS in VESSELS with SINGLE BOTTOMS.

TABLE 6.
(Concluded.)

LONGITUDINAL NUMBER. L × (B + D)	FLAT KEEL PLATE ANGLES. For ½ length Amidships.	FLAT KEEL PLATE ANGLES. Thickness at Ends.	SIDE KEELSONS. For ½ length Amidships.	SIDE KEELSONS. Thickness at Ends.	SIDE KEELSONS. Intercostal Plates.
Above — not exceeding	inches.	inches.	inches.	inches.	inches.
			Double Angles.		
1200 and 1400	3 × 3 × ·24	·24	3 × 3 × ·24	·24	·22
1400 „ 1700	3 × 3 × ·24	·24	3 × 3 × ·24	·24	·22
1700 „ 2000	3 × 3 × ·24	·24	3 × 3 × ·24	·24	·24
2000 „ 2400	3 × 3 × ·24	·24	3 × 3 × ·24	·24	·24
2400 „ 2800	3 × 3 × ·26	·26	3 × 3 × ·26	·26	·26
2800 „ 3200	3 × 3 × ·26	·26	3 × 3 × ·26	·26	·26
3200 „ 3700	3 × 3 × ·28	·28	3 × 3 × ·28	·28	·26
3700 „ 4200	3 × 3 × ·28	·28	3 × 3 × ·28	·28	·28
4200 „ 4700	3 × 3 × ·30	·30	3 × 3 × ·30	·30	·28
4700 „ 5200	3 × 3 × ·32	·32	3 × 3 × ·30	·30	·28
5200 „ 5800	3½ × 3½ × ·32	·32	3½ × 3 × ·30	·30	·30
5800 „ 6400	3½ × 3½ × ·34	·34	3½ × 3 × ·32	·32	·30
6400 „ 7000	3½ × 3½ × ·34	·34	3½ × 3 × ·32	·32	·30
7000 „ 7600	3½ × 3½ × ·36	·36	3½ × 3 × ·34	·34	·32
7600 „ 8200	3½ × 3½ × ·38	·38	4 × 3 × ·34	·34	·32
8200 „ 8800	3½ × 3½ × ·40	·40	4 × 3 × ·34	·34	·32
8800 „ 9400	3½ × 3½ × ·42	·40	4 × 3 × ·36	·34	·34
9400 „ 10000	3½ × 3½ × ·42	·40	4 × 3 × ·36	·34	·34
10000 „ 10600	3½ × 3½ × ·44	·42	4½ × 3 × ·36	·34	·34
10600 „ 11200	3½ × 3½ × ·46	·44	4½ × 3½ × ·36	·34	·36
11200 „ 11800	3½ × 3½ × ·48	·46	4½ × 3½ × ·36	·34	·36
11800 „ 12400	4 × 4 × ·48	·46	5 × 3½ × ·36	·34	·36
12400 „ 13000	4 × 4 × ·48	·46	5 × 3½ × ·38	·36	·38
13000 „ 13600	4 × 4 × ·48	·46	5 × 3½ × ·40	·36	·38
13600 „ 14200	4 × 4 × ·48	·46	5 × 3½ × ·40	·36	·38
14200 „ 14800	4 × 4 × ·50	·46	5½ × 3½ × ·40	·36	·38
14800 „ 15400	4 × 4 × ·50	·46	5½ × 3½ × ·40	·36	·38
15400 „ 16000	4 × 4 × ·50	·46	5½ × 3½ × ·42	·36	·38
16000 „ 16600	4 × 4 × ·52	·48	6 × 3½ × ·42	·36	·40
16600 „ 17200	4 × 4 × ·52	·48	6 × 3½ × ·42	·36	·40
			Double Bulb Angles.		
17200 „ 18000	4 × 4 × ·52	·48	7 × 3½ × ·42	·40	·40
18000 „ 19000	4 × 4 × ·54	·50	8 × 3½ × ·46	·44	·40
19000 „ 20000	4 × 4 × ·54	·50	9 × 3½ × ·50	·46	·40
20000 „ 21000	4 × 4 × ·56	·52	10 × 3½ × ·54	·48	·40
			Plate, Four Angles & Rider Plate.†		
21000 „ 22000	4 × 4 × ·56	·52	11 × ·50	·40	·42
22000 „ 24000	4 × 4 × ·58	·54	12 × ·52	·42	·42
24000 „ 26000	4 × 4 × ·58	·54	13 × ·54	·44	·42
26000 „ 28000	4½ × 4½ × ·58	·54	14 × ·56	·46	·42
28000 „ 30000	4½ × 4½ × ·60	·54	15 × ·58	·48	·42
30000 „ 32000	4½ × 4½ × ·60	·54	16 × ·60	·50	·42
32000 „ 34000	4½ × 4½ × ·60	·54	17 × ·62	·52	·42
34000 „ 36000	4½ × 4½ × ·60	·54	18 × ·64	·54	·44

* Where flat plate keels are adopted intercosta plates or centre through plates must be fitted.

** Where a centre through plate keelson i adopted foundation plates must be fitted of th thickness of the centre through plate, and extending not less than 12 inches on each side of the middle line

† The thickness of rider plates is to be as required for the vertical plates, and the width is to be one inch greater than the sum of the wide flanges of the angles.

†† The foundation plate is to be 18 × ·50 inches.

SIDE STRINGERS. TABLE 7.

LONGITUDINAL NUMBER. L × (B + D)	SIDE STRINGER ANGLES.	SIDE STRINGER INTER-COSTAL PLATES.
	inches.	inches.
Above 1200 and not exceeding 2000	3 × 3 × ·24	·22
2000 „ 2400	3 × 3 × ·24	·24
2400 „ 2800	3 × 3 × ·26	·24
2800 „ 3200	3 × 3 × ·26	·26
3200 „ 3700	3 × 3 × ·28	·26
3700 „ 4200	3 × 3 × ·28	·28
4200 „ 4700	3 × 3 × ·30	·28
4700 „ 5200	3 × 3 × ·30	·30
5200 „ 5800	3½ × 3 × ·30	·30
5800 „ 6400	3½ × 3 × ·32	·30
6400 „ 7000	3½ × 3 × ·32	·32
7000 „ 7600	3½ × 3 × ·34	·32
7600 „ 8200	4 × 3 × ·34	·32
8200 „ 8800	4 × 3 × ·34	·34
8800 „ 10000	4 × 3 × ·36	·34
10000 „ 10600	4½ × 3 × ·36	·34
10600 „ 11200	4½ × 3½ × ·36	·34
11200 „ 11800	4½ × 3½ × ·36	·36
11800 „ 12400	5 × 3½ × ·36	·36
12400 „ 13000	5 × 3½ × ·38	·36
13000 „ 13600	5 × 3½ × ·40	·36
13600 „ 14200	5 × 3½ × ·40	·38
14200 „ 15400	5½ × 3½ × ·40	·38
15400 and not exceeding 16000	5½ × 3½ × ·42	·38
16000 „ 16600	6 × 3½ × ·42	·38
16600 „ 17200	6 × 3½ × ·42	·40
17200 „ 20000	6 × 3½ × ·44	·40
20000 „ 22000	6½ × 3½ × ·44	·40
22000 „ 26000	6½ × 3½ × ·46	·42
26000 „ 30000	6½ × 3½ × ·48	·42
30000 „ 32000	6½ × 3½ × ·50	·42
32000 „ 34000	6½ × 3½ × ·50	·44
34000 „ 38000	7 × 3½ × ·50	·44
38000 „ 42000	7 × 3½ × ·52	·44
42000 „ 45000	7 × 3½ × ·52	·46
45000 „ 51000	7 × 3½ × ·54	·46
51000 „ 54000	7 × 4 × ·54	·46
54000 „ 57000	7 × 4 × ·56	·46
57000 „ 60000	7 × 4 × ·56	·48
60000 „ 63000	7 × 4 × ·58	·48
63000 „ 66000	7 × 4 × ·60	·48
66000 „ 70000	7 × 4 × ·62	·48
70000 „ 74000	8 × 4 × ·62	·48
74000 „ 78000	8 × 4 × ·64	·50
78000 „ 82000	8 × 4 × ·66	·50

Intercostal plates attached to the outside plating are to be fitted to the side stringers, where the depth of framing exceeds 3 inches by Table 2, and 4 inches by Table 3.

The number of side stringers to be as required by Tables 2 and 3.

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DOUBLE BOTTOMS.

TABLE 8.

(See Continuation.)

LONGITUDINAL NUMBER. L × (B + D).	CENTRE GIRDER IN CELLULAR BOTTOM.				SIDE GIRDERS.			MARGIN PLATE.			FLOOR PLATES IN CELLULAR BOTTOM, AND BRACKETS.			Height of Tank Side Brackets above Top of Margin Plate.	INNER BOTTOM PLATING.						
	Depth above Top of Keel.	Thickness.			Thickness.			Thickness.			Thickness.				Middle Line Strake except in Boiler space.		Thickness.				
		Half Length Amidships.	At Ends.	In Boiler Space.	In Holds. Half Length Amids.	In Holds. At Ends.	In Boil'r Space	In Holds. Half Length Amidships.	In Holds. At Ends.	In Boiler Space.	In Holds. Half Length Amidships.	In Holds. At Ends.	In Boiler Space.		Breadth.	Thickness. Half Length Amidships.	In Holds. At Ends.	In Holds. Half Length Amidships.	In Holds. At Ends.	In Engine Space.	In Boiler Space including Middle Line Strake.
	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.
Not exceeding 7500	30	·36	·30	·46	·28	·28	·38	·30	·30	·40	·28	·28	·38	2	30	·34	·30	·28	·28	·32	·44
Above 7500 and not exceeding 9000	31	·38	·32	·48	·28	·28	·38	·32	·32	·42	·30	·30	·40	5	31	·36	·32	·30	·28	·34	·46
9000 „ 10500	32	·40	·34	·50	·30	·30	·40	·34	·34	·44	·30	·30	·40	8	32	·38	·32	·30	·28	·34	·46
10500 „ 12000	33	·40	·34	·50	·30	·30	·40	·34	·34	·44	·30	·30	·40	11	33	·38	·32	·30	·28	·34	·46
12000 „ 14000	34	·42	·36	·52	·30	·30	·40	·36	·36	·46	·32	·32	·42	14	34	·40	·34	·32	·30	·36	·48
14000 „ 16000	35	·44	·36	·54	·32	·32	·42	·36	·36	·46	·32	·32	·42	17	35	·40	·34	·32	·30	·38	·48
16000 „ 18000	36	·46	·38	·56	·32	·32	·42	·38	·38	·48	·34	·34	·44	18	36	·42	·36	·34	·30	·40	·50
18000 „ 20000	37	·46	·38	·56	·34	·34	·44	·40	·40	·50	·34	·34	·44	19	37	·44	·36	·36	·32	·42	·52
20000 „ 22000	38	·48	·38	·58	·34	·34	·44	·40	·40	·50	·34	·34	·44	20	38	·44	·36	·36	·32	·44	·52
22000 „ 24000	39	·48	·38	·58	·34	·34	·44	·42	·42	·52	·36	·34	·46	21	39	·44	·36	·36	·32	·44	·52
24000 „ 26500	40	·48	·38	·58	·36	·34	·46	·42	·42	·52	·36	·34	·46	22	40	·46	·38	·38	·34	·46	·54
26500 „ 29000	41	·50	·40	·60	·36	·34	·46	·44	·44	·52	·38	·36	·48	23	41	·48	·40	·38	·34	·46	·54
29000 „ 31500	42	·50	·40	·60	·38	·36	·48	·46	·46	·56	·40	·36	·50	24	42	·50	·40	·40	·34	·48	·56
31500 „ 34000	43	·50	·40	·60	·40	·36	·50	·48	·48	·58	·40	·36	·50	25	43	·50	·40	·40	·36	·48	·56
34000 „ 36800	44	·52	·42	·60	·40	·36	·50	·48	·48	·58	·40	·36	·50	26	44	·52	·42	·40	·36	·50	·56
36800 „ 39600	45	·54	·44	·62	·40	·36	·50	·50	·50	·58	·42	·38	·52	27	45	·52	·42	·40	·36	·50	·56
39600 „ 42600	46	·56	·46	·62	·42	·38	·52	·50	·50	·58	·42	·38	·52	28	46	·54	·44	·42	·38	·52	·58
42600 „ 45600	47	·58	·46	·64	·42	·38	·52	·52	·52	·58	·44	·40	·54	29	47	·54	·44	·42	·38	·52	·58
45600 „ 48600	48	·60	·48	·64	·44	·40	·54	·52	·52	·58	·46	·40	·54	30	48	·56	·46	·44	·40	·54	·60
48600 „ 51800	49	·62	·48	·66	·46	·40	·54	·54	·54	·60	·46	·40	·54	31	49	·58	·46	·46	·40	·56	·62
51800 „ 55000	50	·64	·50	·68	·46	·40	·54	·56	·56	·60	·48	·42	·54	32	50	·58	·46	·48	·42	·58	·62
55000 „ 58400	51	·66	·50	·70	·48	·42	·54	·58	·58	·62	·48	·42	·54	33	51	·60	·46	·48	·42	·58	·64
58400 „ 61800	52	·68	·52	·72	·48	·42	·54	·60	·58	·64	·50	·42	·54	34	52	·60	·46	·50	·44	·60	·64
61800 „ 65400	53	·70	·54	·74	·50	·42	·54	·62	·58	·66	·50	·42	·54	35	52	·62	·48	·52	·44	·62	·66
65400 „ 69000	54	·72	·56	·76	·50	·42	·54	·64	·60	·68	·52	·42	·56	36	53	·64	·50	·52	·44	·62	·66
69000 „ 72800	55	·74	·58	·78	·52	·42	·56	·66	·62	·70	·52	·42	·56	37	53	·66	·52	·54	·44	·64	·66
72800 „ 76700	56	·78	·60	·82	·52	·42	·56	·68	·64	·72	·54	·44	·58	38	54	·68	·54	·54	·44	·64	·68
76700 „ 81000	57	·82	·62	·86	·54	·44	·58	·72	·66	·76	·54	·44	·58	39	54	·70	·58	·56	·46	·66	·70

Number of SIDE GIRDERS in CELLULAR DOUBLE BOTTOMS.

FLOOR PLATES AT EVERY FRAME.			FLOOR PLATES AT ALTERNATE FRAMES.		
The number of Girders to be in accordance with the alternative breadth requiring the greater number.		Number of Side Girders on each side exclusive of Margin Plate.	The number of Girders to be in accordance with the alternative breadth requiring the greater number.		Number of Side Girders on each side exclusive of Margin Plate.
Rule Breadth of Vessel.	Breadth of Inner Bottom Amidships.		Rule Breadth of Vessel.	Breadth of Inner Bottom Amidships.	
Not exceeding Feet. 50	Not exceeding Feet. 36	1	Not exceeding Feet. 34	Not exceeding Feet. 28	1
Above 50 and not exceeding 62	Above 36 and not exceeding 48	2	Above 34 and not exceeding 50	Above 28 and not exceeding 36	2
„ 62 „ „ 74	„ 48 „ „ 60	3			
„ 74 „ „ 86	„ 60 „ „ 72	4			

DOUBLE BOTTOMS.

TABLE 8.

(Concluded.)

LONGITUDINAL NUMBER. L × (B + D).	DIMENSIONS OF ANGLE BARS (*a*).						
	Angles connecting Centre Girder to Flat Keel Plate.	Angles at top of Centre Girder in Cellular Bottom.	Angles connecting Margin Plate to outside Plating.	Frames and Reversed Frames on Floors in Cellular Bottom, Side Girder Angles and Vertical Angles on Centre Girder and Margin Plate.	Vertical Angles connecting Floors and Side Girders.	Intermediate Frames where Floors are fitted at alternate Frames.	Intermediate Reversed Frames where Floors are fitted at alternate Frames.
	ins. ins. ins.	ins. ins. ins.	ins. ins. ins.	ins. ins. ins.	ins. ins. ins.	ins. ins. ins.	ins. ins. ins.
Not exceeding 7500	$3\frac{1}{2} \times 3\frac{1}{2} \times \cdot 36$	$3 \times 3 \times \cdot 34$	$3 \times 3 \times \cdot 30$	$3 \times 3 \times \cdot 28$	$2\frac{1}{2} \times 2\frac{1}{2} \times \cdot 28$	$3\frac{1}{2} \times 3 \times \cdot 30$	$3 \times 2\frac{1}{2} \times \cdot 26$
Above 7500 and not exceeding 9000	$3\frac{1}{2} \times 3\frac{1}{2} \times \cdot 40$	$3 \times 3 \times \cdot 36$	$3 \times 3 \times \cdot 32$	$3 \times 3 \times \cdot 30$	$2\frac{1}{2} \times 2\frac{1}{2} \times \cdot 30$	$3\frac{1}{2} \times 3 \times \cdot 32$	$3 \times 2\frac{1}{2} \times \cdot 28$
9000 „ 10500	$3\frac{1}{2} \times 3\frac{1}{2} \times \cdot 44$	$3 \times 3 \times \cdot 38$	$3\frac{1}{2} \times 3\frac{1}{2} \times \cdot 34$	$3 \times 3 \times \cdot 30$	$2\frac{1}{2} \times 2\frac{1}{2} \times \cdot 30$	$4 \times 3 \times \cdot 32$	$3 \times 2\frac{1}{2} \times \cdot 28$
10500 „ 12000	$3\frac{1}{2} \times 3\frac{1}{2} \times \cdot 46$	$3 \times 3 \times \cdot 38$	$3\frac{1}{2} \times 3\frac{1}{2} \times \cdot 34$	$3 \times 3 \times \cdot 30$	$2\frac{1}{2} \times 2\frac{1}{2} \times \cdot 30$	$4 \times 3 \times \cdot 34$	$3 \times 3 \times \cdot 30$
12000 „ 14000	$4 \times 4 \times \cdot 48$	$3 \times 3 \times \cdot 40$	$3\frac{1}{2} \times 3\frac{1}{2} \times \cdot 36$	$3 \times 3 \times \cdot 32$	$2\frac{1}{2} \times 2\frac{1}{2} \times \cdot 32$	$4\frac{1}{2} \times 3 \times \cdot 34$	$3 \times 3 \times \cdot 30$
14000 „ 16000	$4 \times 4 \times \cdot 50$	$3 \times 3 \times \cdot 40$	$3\frac{1}{2} \times 3\frac{1}{2} \times \cdot 36$	$3 \times 3 \times \cdot 32$	$2\frac{1}{2} \times 2\frac{1}{2} \times \cdot 32$	$4\frac{1}{2} \times 3 \times \cdot 36$	$3\frac{1}{2} \times 3 \times \cdot 32$
16000 „ 18000	$4 \times 4 \times \cdot 52$	$3 \times 3 \times \cdot 42$	$3\frac{1}{2} \times 3\frac{1}{2} \times \cdot 38$	$3 \times 3 \times \cdot 34$	$3 \times 3 \times \cdot 34$	$5 \times 3 \times \cdot 36$	$3\frac{1}{2} \times 3 \times \cdot 32$
18000 „ 20000	$4 \times 4 \times \cdot 54$	$3\frac{1}{2} \times 3\frac{1}{2} \times \cdot 44$	$3\frac{1}{2} \times 3\frac{1}{2} \times \cdot 40$	$3\frac{1}{2} \times 3\frac{1}{2} \times \cdot 34$	$3 \times 3 \times \cdot 34$	$5 \times 3\frac{1}{2} \times \cdot 38$	$3\frac{1}{2} \times 3 \times \cdot 34$
20000 „ 22000	$4 \times 4 \times \cdot 56$	$3\frac{1}{2} \times 3\frac{1}{2} \times \cdot 44$	$3\frac{1}{2} \times 3\frac{1}{2} \times \cdot 40$	$3\frac{1}{2} \times 3\frac{1}{2} \times \cdot 36$	$3 \times 3 \times \cdot 34$	$5 \times 3\frac{1}{2} \times \cdot 40$	$4 \times 3 \times \cdot 36$
22000 „ 24000	$4 \times 4 \times \cdot 58$	$3\frac{1}{2} \times 3\frac{1}{2} \times \cdot 44$	$3\frac{1}{2} \times 3\frac{1}{2} \times \cdot 42$	$3\frac{1}{2} \times 3\frac{1}{2} \times \cdot 36$	$3 \times 3 \times \cdot 36$	$5 \times 3\frac{1}{2} \times \cdot 42$	$4 \times 3 \times \cdot 38$
24000 „ 26500	$4 \times 4 \times \cdot 58$	$3\frac{1}{2} \times 3\frac{1}{2} \times \cdot 46$	$3\frac{1}{2} \times 3\frac{1}{2} \times \cdot 42$	$3\frac{1}{2} \times 3\frac{1}{2} \times \cdot 36$	$3 \times 3 \times \cdot 36$	$5\frac{1}{2} \times 3\frac{1}{2} \times \cdot 42$	$4 \times 3 \times \cdot 40$
26500 „ 29000	$4\frac{1}{2} \times 4\frac{1}{2} \times \cdot 58$	$3\frac{1}{2} \times 3\frac{1}{2} \times \cdot 48$	$3\frac{1}{2} \times 3\frac{1}{2} \times \cdot 44$	$3\frac{1}{2} \times 3\frac{1}{2} \times \cdot 38$	$3 \times 3 \times \cdot 38$	$5\frac{1}{2} \times 3\frac{1}{2} \times \cdot 44$	$4\frac{1}{2} \times 3 \times \cdot 42$
29000 „ 31500	$4\frac{1}{2} \times 4\frac{1}{2} \times \cdot 60$	$3\frac{1}{2} \times 3\frac{1}{2} \times \cdot 50$	$3\frac{1}{2} \times 3\frac{1}{2} \times \cdot 46$	$3\frac{1}{2} \times 3\frac{1}{2} \times \cdot 40$	$3 \times 3 \times \cdot 40$	$5\frac{1}{2} \times 3\frac{1}{2} \times \cdot 46$	$4\frac{1}{2} \times 3\frac{1}{2} \times \cdot 44$
31500 „ 34000	$4\frac{1}{2} \times 4\frac{1}{2} \times \cdot 60$	$3\frac{1}{2} \times 3\frac{1}{2} \times \cdot 50$	$4 \times 4 \times \cdot 48$	$3\frac{1}{2} \times 3\frac{1}{2} \times \cdot 40$	$3 \times 3 \times \cdot 40$	$5\frac{1}{2} \times 3\frac{1}{2} \times \cdot 48$	$4\frac{1}{2} \times 3\frac{1}{2} \times \cdot 46$
34000 „ 36800	$4\frac{1}{2} \times 4\frac{1}{2} \times \cdot 60$	$3\frac{1}{2} \times 3\frac{1}{2} \times \cdot 52$	$4 \times 4 \times \cdot 48$	$3\frac{1}{2} \times 3\frac{1}{2} \times \cdot 42$	$3 \times 3 \times \cdot 40$	—	—
36800 „ 39600	$4\frac{1}{2} \times 4\frac{1}{2} \times \cdot 60$	$3\frac{1}{2} \times 3\frac{1}{2} \times \cdot 52$	$4 \times 4 \times \cdot 50$	$3\frac{1}{2} \times 3\frac{1}{2} \times \cdot 44$	$3 \times 3 \times \cdot 42$	—	—
39600 „ 42600	$5 \times 5 \times \cdot 60$	$3\frac{1}{2} \times 3\frac{1}{2} \times \cdot 54$	$4 \times 4 \times \cdot 50$	$3\frac{1}{2} \times 3\frac{1}{2} \times \cdot 44$	$3 \times 3 \times \cdot 42$	—	—
42600 „ 45600	$5 \times 5 \times \cdot 62$	$3\frac{1}{2} \times 3\frac{1}{2} \times \cdot 54$	$4 \times 4 \times \cdot 52$	$3\frac{1}{2} \times 3\frac{1}{2} \times \cdot 46$	$3 \times 3 \times \cdot 44$	—	—
45600 „ 48600	$5 \times 5 \times \cdot 62$	$3\frac{1}{2} \times 3\frac{1}{2} \times \cdot 56$	$4 \times 4 \times \cdot 52$	$3\frac{1}{2} \times 3\frac{1}{2} \times \cdot 48$	$3 \times 3 \times \cdot 46$	—	—
48600 „ 51800	$5 \times 5 \times \cdot 62$	$3\frac{1}{2} \times 3\frac{1}{2} \times \cdot 58$	$4 \times 4 \times \cdot 54$	$3\frac{1}{2} \times 3\frac{1}{2} \times \cdot 50$	$3 \times 3 \times \cdot 46$	—	—
51800 „ 55000	$5 \times 5 \times \cdot 64$	$3\frac{1}{2} \times 3\frac{1}{2} \times \cdot 58$	$4 \times 4 \times \cdot 56$	$3\frac{1}{2} \times 3\frac{1}{2} \times \cdot 52$	$3\frac{1}{2} \times 3\frac{1}{2} \times \cdot 48$	—	—
55000 „ 58400	$5 \times 5 \times \cdot 66$	$3\frac{1}{2} \times 3\frac{1}{2} \times \cdot 60$	$4 \times 4 \times \cdot 58$	$3\frac{1}{2} \times 3\frac{1}{2} \times \cdot 54$	$3\frac{1}{2} \times 3\frac{1}{2} \times \cdot 48$	—	—
58400 „ 61800	$5 \times 5 \times \cdot 68$	$3\frac{1}{2} \times 3\frac{1}{2} \times \cdot 60$	$4 \times 4 \times \cdot 60$	$3\frac{1}{2} \times 3\frac{1}{2} \times \cdot 54$	$3\frac{1}{2} \times 3\frac{1}{2} \times \cdot 50$	—	—
61800 „ 65400	$5 \times 5 \times \cdot 70$	$3\frac{1}{2} \times 3\frac{1}{2} \times \cdot 62$	$4 \times 4 \times \cdot 62$	$3\frac{1}{2} \times 3\frac{1}{2} \times \cdot 56$	$3\frac{1}{2} \times 3\frac{1}{2} \times \cdot 50$	—	—
65400 „ 69000	$5 \times 5 \times \cdot 72$	$3\frac{1}{2} \times 3\frac{1}{2} \times \cdot 64$	$4 \times 4 \times \cdot 64$	$4 \times 4 \times \cdot 56$	$3\frac{1}{2} \times 3\frac{1}{2} \times \cdot 52$	—	—
69000 „ 72800	$5 \times 5 \times \cdot 74$	$4 \times 4 \times \cdot 66$	$4 \times 4 \times \cdot 66$	$4 \times 4 \times \cdot 58$	$3\frac{1}{2} \times 3\frac{1}{2} \times \cdot 52$	—	—
72800 „ 76700	$5 \times 5 \times \cdot 76$	$4 \times 4 \times \cdot 68$	$4 \times 4 \times \cdot 68$	$4 \times 4 \times \cdot 60$	$3\frac{1}{2} \times 3\frac{1}{2} \times \cdot 54$	—	—
76700 „ 81000	$5 \times 5 \times \cdot 80$	$4 \times 4 \times \cdot 72$	$4 \times 4 \times \cdot 72$	$4 \times 4 \times \cdot 60$	$3\frac{1}{2} \times 3\frac{1}{2} \times \cdot 54$	—	—

(*a*) All angle bars in boiler space (except those attached to outside plating and covered with cement) to be ·10 of an inch thicker than given in the above Table.

In all cases where flanged plates are adopted as a substitute for fitting angles on the edges of floors, brackets, intercostal plates, &c., the *faying surface* should not be less than the breadth of the flange of the angle required by the rule.

Where floors and intercostal plates are flanged on their lower edges as a substitute for fitting attachment angles to the outside plating, such plates are to be ·02 of an inch thicker than that given in the Table.

All angles (except margin angles) may be reduced in thickness as follows :—

Thickness for half length amidship ..	Above ·40 and not exceeding ·50	Above ·50 and not exceeding ·60	Above ·60 and not exceeding ·70	Above ·70 and not exceeding ·80
Reduction at ends	·02	·04	·06	·08

The margin angles where ·60 and above in thickness may be reduced at the ends of the vessel to the same extent as the margin plates to which they are attached.

The floors are to be attached to the centre girder by double angles throughout the engine and boiler spaces in all cases, and where the transverse number is 66 or above, they are to be attached by double angles for one-half the vessel's length amidships.

Where double bottoms are constructed with girders on top of ordinary floors, the frames and reversed frames on the floors are to be of the same thickness as the floor plates to which they are attached, and the breadth of flanges to be as required for frames and reversed frames on floors in cellular bottoms.

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Depths of MARGIN PLATE OF DOUBLE BOTTOMS AND ATTACHMENTS of side framing and tank side brackets to margin plate and inner bottom plating. TABLE 9.

(See Continuation.)

TRANSVERSE NUMBER. B+D.	DEPTH (d) AT MIDDLE OF LENGTH FROM TOP OF MARGIN PLATE TO TOP OF LOWEST TIER OF BEAMS AT SIDE.											
	Feet. Above 7 and not exceeding 10			Feet. Above 10 and not exceeding 13			Feet. Above 13 and not exceeding 16			Feet. Above 16 and not exceeding 19		
	Depth of Margin Plate (exclusive of flange).	Attachment outside Margin Plate. (a)		Depth of Margin Plate (exclusive of flange).	Attachment outside Margin Plate. (a)		Depth of Margin Plate (exclusive of flange).	Attachment outside Margin Plate. (a)		Depth of Margin Plate (exclusive of flange).	Attachment outside Margin Plate. (a)	
		Angle Attachment.	Gussets to Floor Brackets.		Angle Attachment.	Gussets to Floor Brackets.		Angle Attachment.	Gussets to Floor Brackets.		Angle Attachment.	Gussets to Floor Brackets.
Feet. Not exceeding 45	inches. 19	Single angle.	—	inches. 20	Single angle.	—	inches. 21	Single angle.	—	inches. —	—	—
Above 45 and not exceeding 48	20	,,	—	21	,,	—	22	,,	—	—	—	—
48 ,, 51	21	,,	—	22	,,	—	23	,,	—	24	Single angle.	—
51 ,, 54	22	,,	—	23	,,	—	24	,,	—	25	,,	—
54 ,, 57	23	,,	—	24	,,	—	25	,,	—	25	Double angles from collision bulkhead to one-fourth vessel's length from stem.	Every fifth frame.
57 ,, 60	24	,,	—	25	,,	—	25	,,	—	26	,,	,,
60 ,, 63	25	,,	—	25	,,	—	26	Double angles from collision bulkhead to one-fourth vessel's length from stem.	—	27	,,	,,
63 ,, 66	25	,,	—	26	Double angles from collision bulkhead to one-fourth vessel's length from stem.	—	27	,,	Every fifth frame.	28	,,	Every fourth frame.
66 ,, 69	26	Double angles from collision bulkhead to one-fourth vessel's length from stem.	—	27	,,	Every fifth frame.	28	,,	,,	29	Double angles from collision bulkhead to after end of engine room.	,,
69 ,, 72	27	,,	Every fifth frame.	28	,,	,,	29	,,	Every fourth frame.	30	,,	,,
72 ,, 75	28	,,	,,	29	,,	Every fourth frame.	30	Double angles from collision bulkhead to after end of engine room.	,,	31	,,	Every third frame.
75 ,, 78	29	,,	Every fourth frame.	30	Double angles from collision bulkhead to after end of engine room.	,,	31	,,	,,	32	,,	,,
78 ,, 81	30	Double angles from collision bulkhead to after end of engine room.	,,	31	,,	,,	32	,,	Every third frame.	33	,,	,,
81 ,, 84	31	,,	,,	32	,,	Every third frame.	33	,,	,,	34	,,	,,
84 ,, 87	32	,,	Every third frame.	33	,,	,,	34	,,	,,	35	,,	Every second frame.
87 ,, 90	33	,,	,,	34	,,	,,	35	,,	Every second frame.	36	,,	,,
90 ,, 93	34	,,	,,	35	,,	Every second frame.	36	,,	,,	37	Double angles fore and aft.	,,
93 ,, 96	35	,,	Every second frame.	36	,,	,,	37	Double angles fore and aft.	,,	38	,,	,,
96 ,, 99	36	,,	,,	37	Double angles fore and aft.	,,	38	,,	,,	39	,,	Every frame.
99 ,, 102	37	Double angles fore and aft.	,,	38	,,	,,	39	,,	,,	40	,,	,,
102 ,, 105	38	,,	,,	39	,,	,,	40	,,	Every frame.	41	,,	,,
105 ,, 108	39	,,	,,	40	,,	Every frame.	41	,,	,,	42	,,	,,
108 ,, 114	40	,,	Every frame.	41	,,	,,	42	,,	,,	43	,,	,,
114 ,, 122	41	,,	,,	42	,,	,,	43	,,	,,	44	,,	,,
122 ,, 130	42	,,	,,	43	,,	,,	44	,,	,,	—	—	—

Depths of MARGIN PLATE OF DOUBLE BOTTOMS AND ATTACHMENTS of side framing and tank side brackets to margin plate and inner bottom plating.

TABLE 9.
(Concluded.)

TRANSVERSE NUMBER. B+D.	DEPTH (d) AT MIDDLE OF LENGTH FROM TOP OF MARGIN PLATE TO TOP OF LOWEST TIER OF BEAMS AT SIDE.								
	Feet. Above 19 and not exceeding 22			Feet. Above 22 and not exceeding 25			Feet. Above 25 and not exceeding 27		
	Depth of Margin Plate (exclusive of flange).	Attachment outside Margin Plate. (*a*)		Depth of Margin Plate (exclusive of flange).	Attachment outside Margin Plate. (*a*)		Depth of Margin Plate (exclusive of flange).	Attachment outside Margin Plate. (*a*)	
		Angle Attachment.	Gussets to Floor Brackets.		Angle Attachment.	Gussets to Floor Brackets.		Angle Attachment.	Gussets to Floor Brackets.
Feet.	inches.			inches.			inches.		
Not exceeding 45	—	—	—	—	—	—	—	—	—
Above 45 and not exceeding 48	—	—	—	—	—	—	—	—	—
48 „ 51	—	—	—	—	—	—	—	—	—
51 „ 54	—	—	—	—	—	—	—	—	—
54 „ 57	26	Double angles from collision bulkhead to one-fourth vessel's length from stem.	Every fourth frame.	—	—	—	—	—	—
57 „ 60	27	„	„	—	—	—	—	—	—
60 „ 63	28	Double angles from collision bulkhead to after end of engine room.	„	29	Double angles from collision bulkhead to after end of engine room.	Every third frame.	—	—	—
63 „ 66	29	„	„	30	„	„	—	—	—
66 „ 69	30	„	Every third frame.	31	„	Every second frame.	32	Double angles fore and aft.	Every frame.
69 „ 72	31	„	„	32	„	„	33	„	„
72 „ 75	32	„	„	33	„	„	34	„	„
75 „ 78	33	„	„	34	Double angles fore and aft.	„	35	„	„
78 „ 81	34	„	Every second frame.	35	„	„	36	„	„
81 „ 84	35	„	„	36	„	Every frame.	37	„	„
84 „ 87	36	Double angles fore and aft.	„	37	„	„	38	„	„
87 „ 90	37	„	„	38	„	„	39	„	„
90 „ 93	38	„	Every frame.	39	„	„	40	„	„
93 „ 96	39	„	„	40	„	„	41	„	„
96 „ 99	40	„	„	41	„	„	—	—	—
99 „ 102	41	„	„	42	„	„	—	—	—
102 „ 105	42	„	„	43	„	„	—	—	—
105 „ 108	43	„	„	—	—	—	—	—	—
108 „ 114	44	„	„	—	—	—	—	—	—
114 „ 122	—	—	—	—	—	—	—	—	—
122 „ 130	—	—	—	—	—	—	—	—	—

CONNECTION OF FLOORS AND OUTSIDE BRACKETS TO MARGIN PLATES.		
Depth of Margin Plate.	Number of Rivets in each flange of vertical angles.	Diameter of Rivets.
inches. inches.		inch.
19 and not exceeding 24	5	$\frac{3}{4}$
Above 24 „ 28	6	$\frac{3}{4}$
28 „ 30	6	$\frac{7}{8}$
30 „ 35	7	$\frac{7}{8}$
35 „ 40	8	$\frac{7}{8}$
40 „ 44	9	$\frac{7}{8}$
Where double angles are fitted there may be one rivet less than required above.		

(*a*) If it is desired to dispense with the double angles, other efficient methods of connection may be submitted for approval.

In high powered vessels, when the Committee may consider it necessary, the gusset plates are to be fitted on every frame in way of the machinery space, or a continuous plate may be fitted in lieu of gusset plates.

The breadth of the margin plate may be gradually reduced abaft the three-fifths length amidships towards the after end of the tank where it may be 15 per cent. less than the midship depth.

All web frames are to be attached to the margin plate by double angles. Where web frames are above 15 inches in depth, they are also to be attached to the inner bottom plating by gusset plates or angles. Where the web frames are above 17 inches and not exceeding 20 inches in depth, an additional gusset is to be fitted to the frame midway between the webs; where above 20 inches and not exceeding 26 inches in depth, gussets are to be fitted at every alternate frame; and where above 26 inches in depth, a gusset is to be fitted at every frame.

LLOYD'S REGISTER OF SHIPPING, LONDON.
11th May, 1911

Sizes of BULKHEAD STIFFENERS spaced 30 INCHES apart and fitted with BRACKET ATTACHMENTS at top and bottom in accordance with Table 10B.

TABLE 10.

(See Continuation.)

Overall Length of Stiffener, including End Attachments.		HEIGHT OF TOP OF BULKHEAD AT MIDDLE LINE ABOVE TOP OF STIFFENER.							
		Feet. 0	Feet. 2	Feet. 4	Feet. 6	Feet. 8	Feet. 10	Feet. 12	
Feet.		inches.	inches.	inches.	inches.	inches.	inches.	inches.	
8	ANGLES ^	$3\frac{1}{2} \times 2\frac{1}{2} \times \cdot28$	$4 \times 3 \times \cdot30$	$4\frac{1}{2} \times 3 \times \cdot32$	$5 \times 3 \times \cdot32$	$5\frac{1}{2} \times 3 \times \cdot32$	$5\frac{1}{2} \times 3 \times \cdot38$	$6 \times 3 \times \cdot36$ 4·31	ANGLE
9		$4 \times 2\frac{1}{2} \times \cdot30$	$4\frac{1}{2} \times 3 \times \cdot32$	$5 \times 3 \times \cdot36$	$5\frac{1}{2} \times 3 \times \cdot36$	$6 \times 3 \times \cdot36$	$6 \times 3 \times \cdot42$	$5\frac{1}{2} \times 3 \times \cdot32$ 5·80	BULB ANGLES ^
10		$4\frac{1}{2} \times 3 \times \cdot32$	$5 \times 3 \times \cdot36$	$5\frac{1}{2} \times 3 \times \cdot38$	$6 \times 3 \times \cdot38$	$5\frac{1}{2} \times 3 \times \cdot32$	$5\frac{1}{2} \times 3 \times \cdot40$	$6 \times 3 \times \cdot38$	
11		$5 \times 3 \times \cdot34$	$5\frac{1}{2} \times 3 \times \cdot38$	$6 \times 3 \times \cdot40$	$5\frac{1}{2} \times 3 \times \cdot36$	$6 \times 3 \times \cdot34$	$6\frac{1}{2} \times 3 \times \cdot34$	$6\frac{1}{2} \times 3 \times \cdot40$	
12		$5\frac{1}{2} \times 3 \times \cdot36$	$6 \times 3 \times \cdot40$	$5\frac{1}{2} \times 3 \times \cdot38$	$6 \times 3 \times \cdot38$	$6\frac{1}{2} \times 3 \times \cdot38$	$7 \times 3 \times \cdot36$	$7 \times 3 \times \cdot44$	
13	v	$6 \times 3 \times \cdot38$	$5\frac{1}{2} \times 3 \times \cdot36$	$6 \times 3 \times \cdot40$	$6\frac{1}{2} \times 3 \times \cdot40$	$7 \times 3 \times \cdot40$	$7\frac{1}{2} \times 3 \times \cdot38$	$7\frac{1}{2} \times 3 \times \cdot46$	
14	BULB ANGLES ^	$5\frac{1}{2} \times 3 \times \cdot34$	$6 \times 3 \times \cdot40$	$6\frac{1}{2} \times 3 \times \cdot42$	$7 \times 3 \times \cdot42$	$7\frac{1}{2} \times 3 \times \cdot42$	$8 \times 3 \times \cdot42$	$8\frac{1}{2} \times 3 \times \cdot42$	
15		$6 \times 3 \times \cdot36$	$6\frac{1}{2} \times 3 \times \cdot42$	$7 \times 3 \times \cdot44$	$7\frac{1}{2} \times 3 \times \cdot44$	$8 \times 3 \times \cdot46$	$8\frac{1}{2} \times 3 \times \cdot46$	$9 \times 3 \times \cdot44$	
16		$6\frac{1}{2} \times 3 \times \cdot38$	$7 \times 3 \times \cdot44$	$7\frac{1}{2} \times 3 \times \cdot46$	$8 \times 3 \times \cdot48$	$8\frac{1}{2} \times 3 \times \cdot48$	$9 \times 3 \times \cdot48$	$9\frac{1}{2} \times 3\frac{1}{2} \times \cdot46$	
17		$7 \times 3 \times \cdot40$	$7\frac{1}{2} \times 3 \times \cdot44$	$8 \times 3 \times \cdot48$	$8\frac{1}{2} \times 3 \times \cdot50$	$9 \times 3 \times \cdot50$	$9\frac{1}{2} \times 3\frac{1}{2} \times \cdot50$	$10 \times 3\frac{1}{2} \times \cdot50$	
18		$7\frac{1}{2} \times 3 \times \cdot42$	$8 \times 3 \times \cdot46$	$8\frac{1}{2} \times 3 \times \cdot50$	$9 \times 3 \times \cdot52$	$9\frac{1}{2} \times 3\frac{1}{2} \times \cdot52$	$10 \times 3\frac{1}{2} \times \cdot52$	$10\frac{1}{2} \times 3\frac{1}{2} \times \cdot52$	
19		$8 \times 3 \times \cdot44$	$8\frac{1}{2} \times 3 \times \cdot50$	$9 \times 3 \times \cdot52$	$9\frac{1}{2} \times 3\frac{1}{2} \times \cdot52$	$10 \times 3\frac{1}{2} \times \cdot56$	$10\frac{1}{2} \times 3\frac{1}{2} \times \cdot56$	$11 \times 3\frac{1}{2} \times \cdot56$	
20		$8\frac{1}{2} \times 3 \times \cdot46$	$9 \times 3 \times \cdot52$	$9\frac{1}{2} \times 3\frac{1}{2} \times \cdot52$	$10 \times 3\frac{1}{2} \times \cdot56$	$11 \times 3\frac{1}{2} \times \cdot50$	$11\frac{1}{2} \times 3\frac{1}{2} \times \cdot50$	$12 \times 3\frac{1}{2} \times \cdot50$	
21		$9 \times 3 \times \cdot48$	$9\frac{1}{2} \times 3\frac{1}{2} \times \cdot52$	$10 \times 3\frac{1}{2} \times \cdot56$	$11 \times 3\frac{1}{2} \times \cdot50$	$11\frac{1}{2} \times 3\frac{1}{2} \times \cdot52$	$12 \times 3\frac{1}{2} \times \cdot54$	$12 \times 3\frac{1}{2} \times \cdot62$	BULB ANGLES v
22		$9\frac{1}{2} \times 3\frac{1}{2} \times \cdot50$	$10 \times 3\frac{1}{2} \times \cdot54$	$11 \times 3\frac{1}{2} \times \cdot50$	$11\frac{1}{2} \times 3\frac{1}{2} \times \cdot52$	$12 \times 3\frac{1}{2} \times \cdot54$	$12 \times 3\frac{1}{2} \times \cdot64$	$12 \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot56$ ·60	CHANNELS ^
23		$10 \times 3\frac{1}{2} \times \cdot52$	$11 \times 3\frac{1}{2} \times \cdot48$	$11\frac{1}{2} \times 3\frac{1}{2} \times \cdot52$	$12 \times 3\frac{1}{2} \times \cdot54$	$12 \times 3\frac{1}{2} \times \cdot64$	$12 \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot56$ ·60	$12 \times 4 \times 4 \times \cdot52$ ·625	
24	v	$10\frac{1}{2} \times 3\frac{1}{2} \times \cdot54$	$11\frac{1}{2} \times 3\frac{1}{2} \times \cdot50$	$12 \times 3\frac{1}{2} \times \cdot54$	$12 \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot46$ ·60	$12 \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot60$ ·60	$12 \times 4 \times 4 \times \cdot58$ ·625	$13 \times 4 \times 4 \times \cdot54$ ·625	v

Sizes for intermediate lengths of stiffener and heights of bulkhead deck should be obtained by interpolation.
Sizes of stiffeners are based on British Standard Sections.
In the case of channel sections the upper thickness is that of the web and the lower thickness that of the flange.
Other forms of stiffeners may be adopted if they provide not less strength and stiffness than those tabulated, and the spacing may be increased to a maximum amount of 36 inches provided the stiffeners be correspondingly increased in strength and stiffness.

Sizes of BULKHEAD STIFFENERS spaced 30 INCHES apart and fitted with BRACKET ATTACHMENTS at top and bottom in accordance with Table 10B.

TABLE **10.**

(See Continuation.)

Overall Length of Stiffener, including End Attachments.		HEIGHT OF TOP OF BULKHEAD AT MIDDLE LINE ABOVE TOP OF STIFFENER.							
		Feet. 14	Feet. 16	Feet. 18	Feet. 20	Feet. 22	Feet. 24	Feet. 26	
Feet.		inches.	inches.	inches.	inches.	inches.	inches.	inches.	
8	ANGLE	6 × 3 × ·40	$5\frac{1}{2}$ × 3 × ·30	$5\frac{1}{2}$ × 3 × ·36	6 × 3 × ·32	6 × 3 × ·36	6 × 3 × ·40	$6\frac{1}{2}$ × 3 × ·34	BULB ANGLES
9		$5\frac{1}{2}$ × 3 × ·40	6 × 3 × ·36	6 × 3 × ·42	$6\frac{1}{2}$ × 3 × ·38	$6\frac{1}{2}$ × 3 × ·42	7 × 3 × ·36	7 × 3 × ·40	
10		$6\frac{1}{2}$ × 3 × ·34	$6\frac{1}{2}$ × 3 × ·40	7 × 3 × ·36	7 × 3 × ·42	7 × 3 × ·46	$7\frac{1}{2}$ × 3 × ·42	$7\frac{1}{2}$ × 3 × ·46	
11		7 × 3 × ·38	7 × 3 × ·44	$7\frac{1}{2}$ × 3 × ·40	$7\frac{1}{2}$ × 3 × ·46	8 × 3 × ·42	8 × 3 × ·48	$8\frac{1}{2}$ × 3 × ·44	
12		$7\frac{1}{2}$ × 3 × ·42	$7\frac{1}{2}$ × 3 × ·48	8 × 3 × ·44	$8\frac{1}{2}$ × 3 × ·42	$8\frac{1}{2}$ × 3 × ·48	$8\frac{1}{2}$ × 3 × ·52	9 × 3 × ·48	
13		8 × 3 × ·46	$8\frac{1}{2}$ × 3 × ·44	$8\frac{1}{2}$ × 3 × ·50	9 × 3 × ·46	9 × 3 × ·52	$9\frac{1}{2}$ × $3\frac{1}{2}$ × ·46	$9\frac{1}{2}$ × $3\frac{1}{2}$ × ·52	
14		$8\frac{1}{2}$ × 3 × ·48	9 × 3 × ·46	9 × 3 × ·54	$9\frac{1}{2}$ × $3\frac{1}{2}$ × ·48	10 × $3\frac{1}{2}$ × ·46	10 × $3\frac{1}{2}$ × ·52	$10\frac{1}{2}$ × $3\frac{1}{2}$ × ·48	
15		9 × 3 × ·52	$9\frac{1}{2}$ × $3\frac{1}{2}$ × ·48	10 × $3\frac{1}{2}$ × ·48	10 × $3\frac{1}{2}$ × ·54	$10\frac{1}{2}$ × $3\frac{1}{2}$ × ·50	$10\frac{1}{2}$ × $3\frac{1}{2}$ × ·56	11 × $3\frac{1}{2}$ × ·52	
16	BULB ANGLES	10 × $3\frac{1}{2}$ × ·46	10 × $3\frac{1}{2}$ × ·52	$10\frac{1}{2}$ × $3\frac{1}{2}$ × ·52	11 × $3\frac{1}{2}$ × ·50	11 × $3\frac{1}{2}$ × ·54	$11\frac{1}{2}$ × $3\frac{1}{2}$ × ·52	12 × $3\frac{1}{2}$ × ·50	
17		10 × $3\frac{1}{2}$ × ·58	$10\frac{1}{2}$ × $3\frac{1}{2}$ × ·56	11 × $3\frac{1}{2}$ × ·54	$11\frac{1}{2}$ × $3\frac{1}{2}$ × ·52	12 × $3\frac{1}{2}$ × ·52	12 × $3\frac{1}{2}$ × ·56	12 × $3\frac{1}{2}$ × ·62	CHANNELS
18		11 × $3\frac{1}{2}$ × ·52	$11\frac{1}{2}$ × $3\frac{1}{2}$ × ·52	12 × $3\frac{1}{2}$ × ·50	12 × $3\frac{1}{2}$ × ·56	12 × $3\frac{1}{2}$ × ·62	12 × $3\frac{1}{2}$ × $3\frac{1}{2}$ × ·50 ·60	12 × $3\frac{1}{2}$ × $3\frac{1}{2}$ × ·58 ·60	
19		$11\frac{1}{2}$ × $3\frac{1}{2}$ × ·54	12 × $3\frac{1}{2}$ × ·54	12 × $3\frac{1}{2}$ × ·62	12 × $3\frac{1}{2}$ × $3\frac{1}{2}$ × ·50 ·60	12 × $3\frac{1}{2}$ × $3\frac{1}{2}$ × ·58 ·60	12 × 4 × 4 × ·52 ·625	12 × 4 × 4 × ·60 ·625	
20		12 × $3\frac{1}{2}$ × ·58	12 × $3\frac{1}{2}$ × $3\frac{1}{2}$ × ·46 ·60	12 × $3\frac{1}{2}$ × $3\frac{1}{2}$ × ·56 ·60	12 × 4 × 4 × ·50 ·625	12 × 4 × 4 × ·60 ·625	13 × 4 × 4 × ·50 ·625	13 × 4 × 4 × ·60 ·625	
21		12 × $3\frac{1}{2}$ × $3\frac{1}{2}$ × ·52 ·60	12 × 4 × 4 × ·46 ·625	12 × 4 × 4 × ·56 ·625	13 × 4 × 4 × ·50 ·625	13 × 4 × 4 × ·60 ·625	14 × 4 × 4 × ·52 ·625	14 × 4 × 4 × ·60 ·625	
22	CHANNELS	12 × 4 × 4 × ·50 ·625	12 × 4 × 4 × ·62 ·625	13 × 4 × 4 × ·56 ·625	14 × 4 × 4 × ·50 ·625	14 × 4 × 4 × ·58 ·625	15 × 4 × 4 × ·54 ·625	15 × 4 × 4 × ·62 ·625	
23		13 × 4 × 4 × ·48 ·625	13 × 4 × 4 × ·58 ·625	14 × 4 × 4 × ·52 ·625	15 × 4 × 4 × ·52 ·625	15 × 4 × 4 × ·60 ·625	15 × 4 × 4 × ·68 ·625	15 × ·40 3 × 3 × ·40	BUILT STIFFENERS (Plate & Double Face Angles.)
24		14 × 4 × 4 × ·50 ·625	14 × 4 × 4 × ·60 ·625	15 × 4 × 4 × ·56 ·625	15 × 4 × 4 × ·66 ·625	15 × ·40 3 × 3 × ·40	15 × ·42 3 × 3 × ·42	15 × ·44 3 × 3 × ·44	

Sizes for intermediate length of stiffener and heights of bulkhead deck should be obtained by interpolation.

Sizes of stiffeners are based on British Standard Sections.

In the case of channel sections the upper thickness is that of the web and the lower thickness that of the flange.

Other forms of stiffeners may be adopted if they provide not less strength and stiffness than those tabulated, and the spacing may be increased to a maximum amount of 36 inches provided the stiffeners be correspondingly increased in strength and stiffness.

Sizes of BULKHEAD STIFFENERS spaced 30 INCHES apart and fitted with BRACKET ATTACHMENTS at top and bottom in accordance with Table 10B.

TABLE 10.
(Concluded.)

Overall Length of Stiffener, including End Attachments.		HEIGHT OF TOP OF BULKHEAD AT MIDDLE LINE ABOVE TOP OF STIFFENER.							
		Feet. 28	Feet. 30	Feet. 32	Feet. 34	Feet. 36	Feet. 38	Feet. 40	
Feet.		inches.	inches.	inches.	inches.	inches.	inches.	inches.	
8	BULB ANGLES	$6\frac{1}{2} \times 3 \times \cdot38$	$6\frac{1}{2} \times 3 \times \cdot42$	$7 \times 3 \times \cdot36$	$7 \times 3 \times \cdot40$	$7 \times 3 \times \cdot44$	$7 \times 3 \times \cdot46$	$7\frac{1}{2} \times 3 \times \cdot40$	BULB ANGLES
9		$7 \times 3 \times \cdot46$	$7\frac{1}{2} \times 3 \times \cdot40$	$7\frac{1}{2} \times 3 \times \cdot44$	$7\frac{1}{2} \times 3 \times \cdot46$	$8 \times 3 \times \cdot42$	$8 \times 3 \times \cdot44$	$8 \times 3 \times \cdot48$	
10		$8 \times 3 \times \cdot42$	$8 \times 3 \times \cdot46$	$8 \times 3 \times \cdot50$	$8\frac{1}{2} \times 3 \times \cdot46$	$8\frac{1}{2} \times 3 \times \cdot48$	$8\frac{1}{2} \times 3 \times \cdot52$	$9 \times 3 \times \cdot46$	
11		$8\frac{1}{2} \times 3 \times \cdot48$	$8\frac{1}{2} \times 3 \times \cdot52$	$9 \times 3 \times \cdot46$	$9 \times 3 \times \cdot52$	$9 \times 3 \times \cdot56$	$9\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$	$9\frac{1}{2} \times 3\frac{1}{2} \times \cdot52$	
12		$9 \times 3 \times \cdot54$	$9\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$	$9\frac{1}{2} \times 3\frac{1}{2} \times \cdot52$	$10 \times 3\frac{1}{2} \times \cdot48$	$10 \times 3\frac{1}{2} \times \cdot52$	$10 \times 3\frac{1}{2} \times \cdot56$	$10\frac{1}{2} \times 3\frac{1}{2} \times \cdot50$	
13		$10 \times 3\frac{1}{2} \times \cdot48$	$10 \times 3\frac{1}{2} \times \cdot54$	$10\frac{1}{2} \times 3\frac{1}{2} \times \cdot50$	$10\frac{1}{2} \times 3\frac{1}{2} \times \cdot54$	$11 \times 3\frac{1}{2} \times \cdot50$	$11 \times 3\frac{1}{2} \times \cdot54$	$11\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$	
14		$10\frac{1}{2} \times 3\frac{1}{2} \times \cdot54$	$11 \times 3\frac{1}{2} \times \cdot50$	$11 \times 3\frac{1}{2} \times \cdot54$	$11\frac{1}{2} \times 3\frac{1}{2} \times \cdot50$	$11\frac{1}{2} \times 3\frac{1}{2} \times \cdot54$	$12 \times 3\frac{1}{2} \times \cdot50$	$12 \times 3\frac{1}{2} \times \cdot54$	
15		$11\frac{1}{2} \times 3\frac{1}{2} \times \cdot50$	$11\frac{1}{2} \times 3\frac{1}{2} \times \cdot54$	$12 \times 3\frac{1}{2} \times \cdot52$	$12 \times 3\frac{1}{2} \times \cdot56$	$12 \times 3\frac{1}{2} \times \cdot60$	$12 \times 3\frac{1}{2} \times \cdot64$	$12 \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot50$ $\cdot60$	CHANNELS
16		$12 \times 3\frac{1}{2} \times \cdot56$	$12 \times 3\frac{1}{2} \times \cdot60$	$12 \times 3\frac{1}{2} \times \cdot64$	$12 \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot52$ $\cdot60$	$12 \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot58$ $\cdot60$	$12 \times 4 \times 4 \times \cdot48$ $\cdot625$	$12 \times 4 \times 4 \times \cdot54$ $\cdot625$	
17		$12 \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$ $\cdot60$	$12 \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot56$ $\cdot60$	$12 \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot62$ $\cdot60$	$12 \times 4 \times 4 \times \cdot54$ $\cdot625$	$12 \times 4 \times 4 \times \cdot60$ $\cdot625$	$13 \times 4 \times 4 \times \cdot50$ $\cdot625$	$13 \times 4 \times 4 \times \cdot56$ $\cdot625$	
18		$12 \times 4 \times 4 \times \cdot50$ $\cdot625$	$12 \times 4 \times 4 \times \cdot58$ $\cdot625$	$13 \times 4 \times 4 \times \cdot48$ $\cdot625$	$13 \times 4 \times 4 \times \cdot54$ $\cdot625$	$13 \times 4 \times 4 \times \cdot62$ $\cdot625$	$14 \times 4 \times 4 \times \cdot52$ $\cdot625$	$14 \times 4 \times 4 \times \cdot58$ $\cdot625$	
19		$13 \times 4 \times 4 \times \cdot50$ $\cdot625$	$13 \times 4 \times 4 \times \cdot58$ $\cdot625$	$14 \times 4 \times 4 \times \cdot50$ $\cdot625$	$14 \times 4 \times 4 \times \cdot56$ $\cdot625$	$14 \times 4 \times 4 \times \cdot62$ $\cdot625$	$15 \times 4 \times 4 \times \cdot56$ $\cdot625$	$15 \times 4 \times 4 \times \cdot62$ $\cdot625$	
20		$14 \times 4 \times 4 \times \cdot52$ $\cdot625$	$14 \times 4 \times 4 \times \cdot58$ $\cdot625$	$15 \times 4 \times 4 \times \cdot52$ $\cdot625$	$15 \times 4 \times 4 \times \cdot58$ $\cdot625$	$15 \times 4 \times 4 \times \cdot66$ $\cdot625$	$15 \times \cdot40$ $3 \times 3 \times \cdot40$	$15 \times \cdot42$ $3 \times 3 \times \cdot42$	BUILT STIFFENERS (Plate and Double Face Angles).
21		$15 \times 4 \times 4 \times \cdot54$ $\cdot625$	$15 \times 4 \times 4 \times \cdot62$ $\cdot625$	$15 \times 4 \times 4 \times \cdot68$ $\cdot625$	$15 \times \cdot40$ $3 \times 3 \times \cdot40$	$15 \times \cdot42$ $3 \times 3 \times \cdot42$	$15 \times \cdot44$ $3 \times 3 \times \cdot44$	$15 \times \cdot46$ $3 \times 3 \times \cdot46$	
22		$15 \times 4 \times 4 \times \cdot70$ $\cdot625$	$15 \times \cdot40$ $3 \times 3 \times \cdot40$	$15 \times \cdot42$ $3 \times 3 \times \cdot42$	$15 \times \cdot44$ $3 \times 3 \times \cdot44$	$15 \times \cdot46$ $3 \times 3 \times \cdot46$	$15 \times \cdot44$ $3\frac{1}{2} \times 3\frac{1}{2} \times \cdot44$		
23	BUILT STIFFENERS	$15 \times \cdot42$ $3 \times 3 \times \cdot42$	$15 \times \cdot44$ $3 \times 3 \times \cdot44$	$15 \times \cdot46$ $3 \times 3 \times \cdot46$	$15 \times \cdot44$ $3\frac{1}{2} \times 3\frac{1}{2} \times \cdot44$	$15 \times \cdot46$ $3\frac{1}{2} \times 3\frac{1}{2} \times \cdot46$	$15 \times \cdot48$ $3\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$		
24		$15 \times \cdot46$ $3 \times 3 \times \cdot46$	$15 \times \cdot44$ $3\frac{1}{2} \times 3\frac{1}{2} \times \cdot44$	$15 \times \cdot46$ $3\frac{1}{2} \times 3\frac{1}{2} \times \cdot46$	$15 \times \cdot48$ $3\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$	$15 \times \cdot50$ $3\frac{1}{2} \times 3\frac{1}{2} \times \cdot50$			

Sizes for intermediate lengths of stiffener and heights of bulkhead deck should be obtained by interpolation.

Sizes of stiffeners are based on British Standard Sections.

In the case of channel sections the upper thickness is that of the web and the lower thickness that of the flange.

Other forms of stiffeners may be adopted if they provide not less strength and stiffness than those tabulated, and the spacing may be increased to a maximum amount of 36 inches provided the stiffeners be correspondingly increased in strength and stiffness.

LLOYD'S REGISTER OF SHIPPING, LONDON.—*6th May, 1915.*

Sizes of BULKHEAD STIFFENERS spaced 30 INCHES apart and fitted with LUG ATTACHMENTS at top and bottom in accordance with Table 10B.

TABLE 10A.

(See Continuation.)

Overall Length of Stiffener, including End Attachments.		HEIGHT OF TOP OF BULKHEAD AT MIDDLE LINE ABOVE TOP OF STIFFENER.							
		Feet. 0	Feet. 2	Feet. 4	Feet. 6	Feet. 8	Feet. 10	Feet. 12	
Feet.		inches.	inches.	inches.	inches.	inches.	inches.	inches.	
8	ANGLES	*$4\frac{1}{2}\times3\times\cdot32$ $4\times3\times\cdot34$	$5\times3\times\cdot34$	$5\frac{1}{2}\times3\times\cdot38$	$6\times3\times\cdot38$	$5\frac{1}{2}\times3\times\cdot32$	$6\times3\times\cdot32$	$6\times3\times\cdot40$	BULB ANGLES
9	ANGLES	*$5\times3\times\cdot36$ $4\frac{1}{2}\times3\times\cdot40$	$5\frac{1}{2}\times3\times\cdot38$	$6\times3\times\cdot42$	$5\frac{1}{2}\times3\times\cdot38$	$6\times3\times\cdot38$	$6\frac{1}{2}\times3\times\cdot38$	$7\times3\times\cdot36$	BULB ANGLES
10	ANGLES	*$6\times3\times\cdot40$ $5\frac{1}{2}\times3\times\cdot36$	$6\times3\times\cdot44$	$6\times3\times\cdot32$	$6\frac{1}{2}\times3\times\cdot34$	$6\frac{1}{2}\times3\times\cdot44$	$7\times3\times\cdot44$	$7\frac{1}{2}\times3\times\cdot42$	BULB ANGLES
11	ANGLES	$6\times3\times\cdot40$	$6\times3\times\cdot32$	$6\frac{1}{2}\times3\times\cdot36$	$7\times3\times\cdot38$	$7\frac{1}{2}\times3\times\cdot40$	$8\times3\times\cdot40$	$8\times3\times\cdot48$	BULB ANGLES
12	BULB ANGLES	$5\frac{1}{2}\times3\times\cdot38$	$6\frac{1}{2}\times3\times\cdot36$	$7\times3\times\cdot40$	$7\frac{1}{2}\times3\times\cdot44$	$8\times3\times\cdot44$	$8\frac{1}{2}\times3\times\cdot46$	$9\times3\times\cdot46$	BULB ANGLES
13	BULB ANGLES	$6\frac{1}{2}\times3\times\cdot34$	$7\times3\times\cdot40$	$7\frac{1}{2}\times3\times\cdot44$	$8\times3\times\cdot48$	$8\frac{1}{2}\times3\times\cdot50$	$9\times3\times\cdot52$	$9\frac{1}{2}\times3\frac{1}{2}\times\cdot50$	BULB ANGLES
14	BULB ANGLES	$7\times3\times\cdot38$	$7\frac{1}{2}\times3\times\cdot44$	$8\times3\times\cdot50$	$9\times3\times\cdot44$	$9\times3\times\cdot56$	$10\times3\frac{1}{2}\times\cdot46$	$10\times3\frac{1}{2}\times\cdot56$	BULB ANGLES
15	BULB ANGLES	$7\frac{1}{2}\times3\times\cdot42$	$8\times3\times\cdot50$	$9\times3\times\cdot46$	$9\frac{1}{2}\times3\frac{1}{2}\times\cdot48$	$10\times3\frac{1}{2}\times\cdot50$	$10\frac{1}{2}\times3\frac{1}{2}\times\cdot52$	$11\times3\frac{1}{2}\times\cdot52$	BULB ANGLES
16	BULB ANGLES	$8\times3\times\cdot46$	$9\times3\times\cdot44$	$9\frac{1}{2}\times3\frac{1}{2}\times\cdot48$	$10\times3\frac{1}{2}\times\cdot52$	$10\frac{1}{2}\times3\frac{1}{2}\times\cdot56$	$11\frac{1}{2}\times3\frac{1}{2}\times\cdot48$	$12\times3\frac{1}{2}\times\cdot50$	BULB ANGLES
17	BULB ANGLES	$8\frac{1}{2}\times3\times\cdot50$	$9\frac{1}{2}\times3\frac{1}{2}\times\cdot48$	$10\times3\frac{1}{2}\times\cdot54$	$11\times3\frac{1}{2}\times\cdot50$	$11\frac{1}{2}\times3\frac{1}{2}\times\cdot52$	$12\times3\frac{1}{2}\times\cdot54$	$12\times3\frac{1}{2}\times\cdot64$	BULB ANGLES
18	BULB ANGLES	$9\times3\times\cdot54$	$10\times3\frac{1}{2}\times\cdot52$	$11\times3\frac{1}{2}\times\cdot50$	$11\frac{1}{2}\times3\frac{1}{2}\times\cdot54$	$12\times3\frac{1}{2}\times\cdot58$	$12\times3\frac{1}{2}\times3\frac{1}{2}\times\cdot48$ $\cdot60$	$12\times3\frac{1}{2}\times3\frac{1}{2}\times\cdot62$ $\cdot60$	CHANNELS
19	BULB ANGLES	$10\times3\frac{1}{2}\times\cdot50$	$10\frac{1}{2}\times3\frac{1}{2}\times\cdot52$	$11\frac{1}{2}\times3\frac{1}{2}\times\cdot54$	$12\times3\frac{1}{2}\times\cdot58$	$12\times3\frac{1}{2}\times3\frac{1}{2}\times\cdot52$ $\cdot60$	$12\times4\times4\times\cdot50$ $\cdot625$	$13\times4\times4\times\cdot48$ $\cdot625$	CHANNELS
20	BULB ANGLES	$10\frac{1}{2}\times3\frac{1}{2}\times\cdot54$	$11\frac{1}{2}\times3\frac{1}{2}\times\cdot52$	$12\times3\frac{1}{2}\times\cdot58$	$12\times3\frac{1}{2}\times3\frac{1}{2}\times\cdot54$ $\cdot60$	$12\times4\times4\times\cdot54$ $\cdot625$	$13\times4\times4\times\cdot52$ $\cdot625$	$14\times4\times4\times\cdot50$ $\cdot625$	CHANNELS
21	BULB ANGLES	$11\frac{1}{2}\times3\frac{1}{2}\times\cdot50$	$12\times3\frac{1}{2}\times\cdot58$	$12\times3\frac{1}{2}\times3\frac{1}{2}\times\cdot54$ $\cdot60$	$12\times4\times4\times\cdot56$ $\cdot625$	$13\times4\times4\times\cdot56$ $\cdot625$	$14\times4\times4\times\cdot54$ $\cdot625$	$15\times4\times4\times\cdot54$ $\cdot625$	CHANNELS
22	BULB ANGLES	$12\times3\frac{1}{2}\times\cdot54$	$12\times3\frac{1}{2}\times3\frac{1}{2}\times\cdot52$ $\cdot60$	$12\times4\times4\times\cdot56$ $\cdot625$	$13\times4\times4\times\cdot56$ $\cdot625$	$14\times4\times4\times\cdot56$ $\cdot625$	$15\times4\times4\times\cdot56$ $\cdot625$	$15\times\cdot38$ $3\times3\times\cdot40$	BUILT STIFFENERS (Plate and Double Face Angles)
23	CHANNELS	$12\times3\frac{1}{2}\times3\frac{1}{2}\times\cdot46$ $\cdot60$	$12\times4\times4\times\cdot52$ $\cdot625$	$13\times4\times4\times\cdot56$ $\cdot625$	$14\times4\times4\times\cdot58$ $\cdot625$	$15\times4\times4\times\cdot60$ $\cdot625$	$15\times\cdot40$ $3\times3\times\cdot40$	$15\times\cdot38$ $3\frac{1}{2}\times3\frac{1}{2}\times\cdot38$	
24	CHANNELS	$12\times4\times4\times\cdot48$ $\cdot625$	$13\times4\times4\times\cdot54$ $\cdot625$	$14\times4\times4\times\cdot58$ $\cdot625$	$15\times4\times4\times\cdot60$ $\cdot625$	$15\times\cdot40$ $3\times3\times\cdot42$	$15\times\cdot40$ $3\frac{1}{2}\times3\frac{1}{2}\times\cdot40$	$16\times\cdot40$ $3\frac{1}{2}\times3\frac{1}{2}\times\cdot40$	

Sizes for intermediate lengths of stiffener and heights of bulkhead deck should be obtained by interpolation.
Sizes of stiffeners are based on British Standard Sections.
In the case of channel sections the upper thickness is that of the web and the lower thickness that of the flange.
The ends of upper 'tween deck stiffeners marked * may be riveted to boundary bars only (no lug attachment).
Other forms of stiffeners may be adopted if they provide not less strength and stiffness than those tabulated, and the spacing may be increased to a maximum amount of 36 inches provided the stiffeners be correspondingly increased in strength and stiffness.

Sizes of BULKHEAD STIFFENERS spaced 30 INCHES apart and fitted with LUG ATTACHMENTS at top and bottom in accordance with Table 10B.

TABLE 10A.

(See Continuation.)

Overall Length of Stiffener, including End Attachments.		HEIGHT OF TOP OF BULKHEAD AT MIDDLE LINE ABOVE TOP OF STIFFENER.							
		Feet. 14	Feet. 16	Feet. 18	Feet. 20	Feet. 22	Feet. 24	Feet. 26	
Feet.		inches.	inches.	inches.	inches.	inches.	inches.	inches.	
8	BULB ANGLES	$6\frac{1}{2} \times 3 \times \cdot36$	$6\frac{1}{2} \times 3 \times \cdot44$	$7 \times 3 \times \cdot40$	$7 \times 3 \times \cdot46$	$7\frac{1}{2} \times 3 \times \cdot40$	$7\frac{1}{2} \times 3 \times \cdot46$	$8 \times 3 \times \cdot42$	BULB ANGLES
9		$7 \times 3 \times \cdot44$	$7\frac{1}{2} \times 3 \times \cdot40$	$7\frac{1}{2} \times 3 \times \cdot46$	$8 \times 3 \times \cdot44$	$8 \times 3 \times \cdot50$	$8\frac{1}{2} \times 3 \times \cdot46$	$8\frac{1}{2} \times 3 \times \cdot52$	
10		$8 \times 3 \times \cdot40$	$8 \times 3 \times \cdot48$	$8\frac{1}{2} \times 3 \times \cdot46$	$8\frac{1}{2} \times 3 \times \cdot52$	$9 \times 3 \times \cdot48$	$9 \times 3 \times \cdot54$	$9\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$	
11		$8\frac{1}{2} \times 3 \times \cdot48$	$9 \times 3 \times \cdot46$	$9 \times 3 \times \cdot52$	$9\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$	$10 \times 3\frac{1}{2} \times \cdot46$	$10 \times 3\frac{1}{2} \times \cdot52$	$10\frac{1}{2} \times 3\frac{1}{2} \times \cdot50$	
12		$9 \times 3 \times \cdot46$	$9\frac{1}{2} \times 3\frac{1}{2} \times \cdot50$	$10 \times 3\frac{1}{2} \times \cdot50$	$10\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$	$10\frac{1}{2} \times 3\frac{1}{2} \times \cdot54$	$11 \times 3\frac{1}{2} \times \cdot52$	$11\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$	
13		$10 \times 3\frac{1}{2} \times \cdot50$	$10\frac{1}{2} \times 3\frac{1}{2} \times \cdot50$	$11 \times 3\frac{1}{2} \times \cdot48$	$11 \times 3\frac{1}{2} \times \cdot54$	$11\frac{1}{2} \times 3\frac{1}{2} \times \cdot52$	$12 \times 3\frac{1}{2} \times \cdot52$	$12 \times 3\frac{1}{2} \times \cdot56$	
14		$10\frac{1}{2} \times 3\frac{1}{2} \times \cdot56$	$11 \times 3\frac{1}{2} \times \cdot56$	$11\frac{1}{2} \times 3\frac{1}{2} \times \cdot54$	$12 \times 3\frac{1}{2} \times \cdot54$	$12 \times 3\frac{1}{2} \times \cdot60$	$12 \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot46$ $\cdot60$	$12 \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot56$ $\cdot60$	CHANNELS
15		$11\frac{1}{2} \times 3\frac{1}{2} \times \cdot62$	$12 \times 3\frac{1}{2} \times \cdot54$	$12 \times 3\frac{1}{2} \times \cdot60$	$12 \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot50$ $\cdot60$	$12 \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot58$ $\cdot60$	$12 \times 4 \times 4 \times \cdot52$ $\cdot625$	$12 \times 4 \times 4 \times \cdot60$ $\cdot625$	
16		$12 \times 3\frac{1}{2} \times \cdot58$	$12 \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot48$ $\cdot60$	$12 \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot60$ $\cdot60$	$12 \times 4 \times 4 \times \cdot52$ $\cdot625$	$12 \times 4 \times 4 \times \cdot64$ $\cdot625$	$13 \times 4 \times 4 \times \cdot56$ $\cdot625$	$14 \times 4 \times 4 \times \cdot50$ $\cdot625$	
17	CHANNELS	$12 \times 3\frac{1}{2} \times 3\frac{1}{2} \times \cdot56$ $\cdot60$	$12 \times 4 \times 4 \times \cdot52$ $\cdot625$	$12 \times 4 \times 4 \times \cdot64$ $\cdot625$	$13 \times 4 \times 4 \times \cdot56$ $\cdot625$	$14 \times 4 \times 4 \times \cdot50$ $\cdot625$	$14 \times 4 \times 4 \times \cdot60$ $\cdot625$	$15 \times 4 \times 4 \times \cdot54$ $\cdot625$	
18		$12 \times 4 \times 4 \times \cdot60$ $\cdot625$	$13 \times 4 \times 4 \times \cdot54$ $\cdot625$	$14 \times 4 \times 4 \times \cdot50$ $\cdot625$	$14 \times 4 \times 4 \times \cdot60$ $\cdot625$	$15 \times 4 \times 4 \times \cdot56$ $\cdot625$	$15 \times 4 \times 4 \times \cdot64$ $\cdot625$	$15 \times \cdot38$ $3 \times 3 \times \cdot40$	BUILT STIFFENERS (Plate and Double Face Angles).
19		$13 \times 4 \times 4 \times \cdot62$ $\cdot625$	$14 \times 4 \times 4 \times \cdot56$ $\cdot625$	$15 \times 4 \times 4 \times \cdot54$ $\cdot625$	$15 \times 4 \times 4 \times \cdot64$ $\cdot625$	$15 \times \cdot40$ $3 \times 3 \times \cdot40$	$15 \times \cdot38$ $3\frac{1}{2} \times 3\frac{1}{2} \times \cdot38$	$15 \times \cdot40$ $3\frac{1}{2} \times 3\frac{1}{2} \times \cdot40$	
20		$15 \times 4 \times 4 \times \cdot50$ $\cdot625$	$15 \times 4 \times 4 \times \cdot62$ $\cdot625$	$15 \times \cdot38$ $3 \times 3 \times \cdot40$	$15 \times \cdot38$ $3\frac{1}{2} \times 3\frac{1}{2} \times \cdot38$	$15 \times \cdot40$ $3\frac{1}{2} \times 3\frac{1}{2} \times \cdot40$	$15\frac{1}{2} \times \cdot40$ $3\frac{1}{2} \times 3\frac{1}{2} \times \cdot40$	$16 \times \cdot42$ $3\frac{1}{2} \times 3\frac{1}{2} \times \cdot42$	
21		$15 \times 4 \times 4 \times \cdot66$ $\cdot625$	$15 \times \cdot38$ $3\frac{1}{2} \times 3\frac{1}{2} \times \cdot38$	$15 \times \cdot40$ $3\frac{1}{2} \times 3\frac{1}{2} \times \cdot40$	$15\frac{1}{2} \times \cdot40$ $3\frac{1}{2} \times 3\frac{1}{2} \times \cdot40$	$16 \times \cdot42$ $3\frac{1}{2} \times 3\frac{1}{2} \times \cdot42$	$17 \times \cdot40$ $3\frac{1}{2} \times 3\frac{1}{2} \times \cdot40$	$17 \times \cdot42$ $3\frac{1}{2} \times 3\frac{1}{2} \times \cdot42$	
22	BUILT STIFFENERS	$15 \times \cdot38$ $3\frac{1}{2} \times 3\frac{1}{2} \times \cdot38$	$15\frac{1}{2} \times \cdot40$ $3\frac{1}{2} \times 3\frac{1}{2} \times \cdot40$	$16 \times \cdot40$ $3\frac{1}{2} \times 3\frac{1}{2} \times \cdot40$	$17 \times \cdot40$ $3\frac{1}{2} \times 3\frac{1}{2} \times \cdot40$	$17 \times \cdot42$ $3\frac{1}{2} \times 3\frac{1}{2} \times \cdot42$	$18 \times \cdot42$ $3\frac{1}{2} \times 3\frac{1}{2} \times \cdot42$	$18 \times \cdot44$ $3\frac{1}{2} \times 3\frac{1}{2} \times \cdot44$	
23		$15\frac{1}{2} \times \cdot40$ $3\frac{1}{2} \times 3\frac{1}{2} \times \cdot40$	$16 \times \cdot42$ $3\frac{1}{2} \times 3\frac{1}{2} \times \cdot42$	$17 \times \cdot42$ $3\frac{1}{2} \times 3\frac{1}{2} \times \cdot42$	$17 \times \cdot44$ $3\frac{1}{2} \times 3\frac{1}{2} \times \cdot44$	$18 \times \cdot44$ $3\frac{1}{2} \times 3\frac{1}{2} \times \cdot44$	$18\frac{1}{2} \times \cdot44$ $3\frac{1}{2} \times 3\frac{1}{2} \times \cdot44$	$19 \times \cdot46$ $3\frac{1}{2} \times 3\frac{1}{2} \times \cdot46$	
24		$16 \times \cdot42$ $3\frac{1}{2} \times 3\frac{1}{2} \times \cdot42$	$17 \times \cdot42$ $3\frac{1}{2} \times 3\frac{1}{2} \times \cdot42$	$18 \times \cdot42$ $3\frac{1}{2} \times 3\frac{1}{2} \times \cdot42$	$18\frac{1}{2} \times \cdot44$ $3\frac{1}{2} \times 3\frac{1}{2} \times \cdot44$	$18\frac{1}{2} \times \cdot46$ $3\frac{1}{2} \times 3\frac{1}{2} \times \cdot46$	$19\frac{1}{2} \times \cdot46$ $3\frac{1}{2} \times 3\frac{1}{2} \times \cdot46$	$20 \times \cdot46$ $3\frac{1}{2} \times 3\frac{1}{2} \times \cdot46$	

Sizes for intermediate lengths of stiffener and heights of bulkhead deck should be obtained by interpolation.
Sizes of stiffeners are based on British Standard Sections.
In the case of channel sections the upper thickness is that of the web and the lower thickness that of the flange.
Other forms of stiffeners may be adopted if they provide not less strength and stiffness than those tabulated, and the spacing may be increased to a maximum amount of 36 inches provided the stiffeners be correspondingly increased in strength and stiffness.

Sizes of BULKHEAD STIFFENERS spaced 30 INCHES apart and fitted with LUG ATTACHMENTS at top and bottom in accordance with Table 10B.

TABLE 10A. *(Concluded.)*

Overall Length of Stiffener, including End Attachments.		HEIGHT OF TOP OF BULKHEAD AT MIDDLE LINE ABOVE TOP OF STIFFENER.							
		Feet. 28	Feet. 30	Feet. 32	Feet. 34	Feet. 36	Feet. 38	Feet. 40	
Feet. 8	BULB ANGLES	inches. 8 × 3 × ·46	inches. 8½ × 3 × ·42	inches. 8½ × 3 × ·46	inches. 8½ × 3 × ·50	inches. 9 × 3 × ·44	inches. 9 × 3 × ·48	inches. 9 × 3 × ·52	BULB ANGLES
9		9 × 3 × ·46	9 × 3 × ·52	9 × 3 × ·56	9½ × 3½ × ·50	10 × 3½ × ·46	10 × 3½ × ·50	10 × 3½ × ·54	
10		10 × 3½ × ·46	10 × 3½ × ·50	10 × 3½ × ·56	10½ × 3½ × ·52	10½ × 3½ × ·56	11 × 3½ × ·50	11 × 3½ × ·54	
11		10½ × 3½ × ·54	11 × 3½ × ·52	11 × 3½ × ·56	11½ × 3½ × ·52	11½ × 3½ × ·56	12 × 3½ × ·52	12 × 3½ × ·56	
12		11½ × 3½ × ·54	12 × 3½ × ·52	12 × 3½ × ·56	12 × 3½ × ·60	12 × 3½ × 3½ × ·46 ·60	12 × 3½ × 3½ × ·52 ·60	12 × 3½ × 3½ × ·58 ·60	CHANNELS
13		12 × 3½ × ·62	12 × 3½ × 3½ × ·48 ·60	12 × 3½ × 3½ × ·56 ·60	12 × 4 × 4 × ·48 ·625	12 × 4 × 4 × ·54 ·625	12 × 4 × 4 × ·60 ·625	13 × 4 × 4 × ·50 ·625	
14	CHANNELS	12 × 4 × 4 × ·48 ·625	12 × 4 × 4 × ·56 ·625	12 × 4 × 4 × ·64 ·625	13 × 4 × 4 × ·54 ·625	13 × 4 × 4 × ·60 ·625	14 × 4 × 4 × ·52 ·625	14 × 4 × 4 × ·58 ·625	
15		13 × 4 × 4 × ·52 ·625	13 × 4 × 4 × ·60 ·625	14 × 4 × 4 × ·52 ·625	14 × 4 × 4 × ·60 ·625	15 × 4 × 4 × ·52 ·625	15 × 4 × 4 × ·58 ·625	15 × 4 × 4 × ·64 ·625	
16		14 × 4 × 4 × ·58 ·625	15 × 4 × 4 × ·52 ·625	15 × 4 × 4 × ·58 ·625	15 × 4 × 4 × ·66 ·625	15 × ·38 3 × 3 × ·40	15 × ·38 3½ × 3½ × ·38	15 × ·40 3½ × 3½ × ·40	BUILT STIFFENERS (Plate and Double Face Angles).
17		15 × 4 × 4 × ·62 ·625	15 × ·38 3 × 3 × ·38	15 × ·40 3 × 3 × ·42	15 × ·38 3½ × 3½ × ·38	15 × ·40 3½ × 3½ × ·40	15½ × ·40 3½ × 3½ × ·40	16 × ·40 3½ × 3½ × ·40	
18	BUILT STIFFENERS	15 × ·38 3½ × 3½ × ·38	15 × ·40 3½ × 3½ × ·40	15½ × ·40 3½ × 3½ × ·40	16 × ·40 3½ × 3½ × ·40	16 × ·42 3½ × 3½ × ·42	17 × ·40 3½ × 3½ × ·40	17 × ·42 3½ × 3½ × ·42	
19		15½ × ·40 3½ × 3½ × ·40	16 × ·40 3½ × 3½ × ·40	16 × ·42 3½ × 3½ × ·42	17 × ·42 3½ × 3½ × ·42	17 × ·44 3½ × 3½ × ·44	18 × ·42 3½ × 3½ × ·42	18 × ·44 3½ × 3½ × ·44	
20		17 × ·40 3½ × 3½ × ·40	17 × ·42 3½ × 3½ × ·42	17 × ·44 3½ × 3½ × ·44	18 × ·44 3½ × 3½ × ·44	18 × ·46 3½ × 3½ × ·46	18½ × ·46 3½ × 3½ × ·46	19 × ·46 3½ × 3½ × ·46	
21		18 × ·42 3½ × 3½ × ·42	18 × ·44 3½ × 3½ × ·44	18½ × ·44 3½ × 3½ × ·44	18½ × ·46 3½ × 3½ × ·46	19½ × ·46 3½ × 3½ × ·46	20 × ·46 3½ × 3½ × ·46	20½ × ·46 3½ × 3½ × ·46	
22		18½ × ·44 3½ × 3½ × ·44	19 × ·46 3½ × 3½ × ·46	19½ × ·46 3½ × 3½ × ·46	20 × ·46 3½ × 3½ × ·46	21 × ·46 3½ × 3½ × ·46	21 × ·48 3½ × 3½ × ·48		
23		19½ × ·46 3½ × 3½ × ·46	20 × ·46 3½ × 3½ × ·46	21 × ·46 3½ × 3½ × ·46	21 × ·48 3½ × 3½ × ·48	21 × ·46 4 × 4 × ·46	21 × ·48 4 × 4 × ·48		
24		21 × ·46 3½ × 3½ × ·46	21 × ·48 3½ × 3½ × ·48	21 × ·46 4 × 4 × ·46	21 × ·48 4 × 4 × ·48	21 × ·50 4 × 4 × ·50			

Sizes for intermediate lengths of stiffener and heights of bulkhead deck should be obtained by interpolation.
Sizes of stiffeners are based on British Standard Sections.
In the case of channel sections the upper thickness is that of the web and the lower thickness that of the flange.
Other forms of stiffeners may be adopted if they provide not less strength and stiffness than those tabulated, and the spacing may be increased to a maximum amount of 36 inches provided the stiffeners be correspondingly increased in strength and stiffness.

LLOYD'S REGISTER OF SHIPPING, LONDON.—*6th May, 1915.*

TABLE 10B.

ATTACHMENTS FOR STIFFENERS.

Type and Depth (ins.) of Stiffener.	Bracket Attachments.			Lug Attachments.
	Thickness of Bracket in Inches.	Width of Flange at Face of Bracket in Inches.	Number and Diameter of Rivets (ins.) in each Arm of Bracket.	Number and Diameter of Rivets (ins.) in Lugs.
Angles 3 to 6 - -	·34	—	3 of $\frac{3}{4}$	2 of $\frac{3}{4}$
Bulb Angles under $6\frac{1}{2}$ -	·36	—	3 „ $\frac{3}{4}$	2 „ $\frac{3}{4}$
„ „ $6\frac{1}{2}$ - -	·40	—	4 „ $\frac{3}{4}$	3 „ $\frac{3}{4}$
„ „ 7 and $7\frac{1}{2}$ -	·44	—	5 „ $\frac{3}{4}$	3 „ $\frac{3}{4}$
„ „ 8 „ $8\frac{1}{2}$ -	·44	$2\frac{1}{2}$	6 „ $\frac{3}{4}$	4 „ $\frac{3}{4}$
„ „ 9 „ $9\frac{1}{2}$ -	·44	$2\frac{3}{4}$	7 „ $\frac{3}{4}$	4 „ $\frac{3}{4}$
„ „ 10 „ $10\frac{1}{2}$ -	·44	3	7 „ $\frac{7}{8}$	4 „ $\frac{7}{8}$
„ „ 11 „ $11\frac{1}{2}$ -	·44	$3\frac{1}{4}$	8 „ $\frac{7}{8}$	5 „ $\frac{7}{8}$
„ „ 12 - -	·44	$3\frac{1}{2}$	9 „ $\frac{7}{8}$	6 „ $\frac{7}{8}$
Channels $12 \times 3\frac{1}{2} \times 3\frac{1}{2}$ -	·44	$3\frac{1}{2}$	10 „ $\frac{7}{8}$	6 „ $\frac{7}{8}$
„ $12 \times 4 \times 4$ -	·46	$3\frac{1}{2}$	11 „ $\frac{7}{8}$	8 „ $\frac{7}{8}$
„ $13 \times 4 \times 4$ -	·48	4	12 „ $\frac{7}{8}$	8 „ $\frac{7}{8}$
„ $14 \times 4 \times 4$ -	·48	4	13 „ $\frac{7}{8}$	8 „ $\frac{7}{8}$
„ $15 \times 4 \times 4$ -	·50	$4\frac{1}{2}$	14 of $\frac{7}{8}$ (in 2 rows of 7 each)	8 „ $\frac{7}{8}$
Plates 15 with 3 × 3 angles	·50	$4\frac{1}{2}$	16 „ $\frac{7}{8}$ (in 2 rows of 8 each)	8 „ $\frac{7}{8}$
„ 15 „ $3\frac{1}{2} \times 3\frac{1}{2}$ „	·50	$4\frac{1}{2}$	18 „ $\frac{7}{8}$ (in 2 rows of 9 each)	8 „ $\frac{7}{8}$
„ 15–20 - -	—	—	——	8 „ $\frac{7}{8}$
„ 21 - -	—	—	——	10 „ $\frac{7}{8}$

NOTE.—The distance from the heel of the boundary bar to the extremities of the arms of the bracket is not to be less than three times the depth of the tabulated stiffener. Where stiffeners of other forms are adopted the brackets are to be of the size required for the tabulated stiffener.

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TABLE 10C.
THICKNESSES OF BULKHEAD PLATING.

Stiffeners spaced 30″ apart.			Stiffeners spaced 36″ apart.		
Depth at Middle Line from top of Bulkhead to Lower edge of Plate.		Thickness.	Depth at Middle Line from top of Bulkhead to Lower edge of Plate.		Thickness.
Feet. Above	Feet. Not above	Inches.	Feet. Above	Feet. Not above	Inches.
—	8	·26	—	7	·28
8	12	·28	7	10·5	·30
12	16	·30	10·5	14	·32
16	20	·32	14	17·5	·34
20	24	·34	17·5	21	·36
24	28	·36	21	24·5	·38
28	32	·38	24·5	28	·40
32	36	·40	28	31·5	·42
36	40	·42	31·5	35	·44
40	44	·44	35	38·5	·46
44	48	·46	38·5	42	·48
48	52	·48	42	45·5	·50
52	56	·50	45·5	49	·52
56	60	·52	49	52·5	·54
			52·5	56	·56
			56	59·5	·58

Thicknesses for intermediate spacings of stiffeners may be obtained by interpolation.

TABLE 10D.
SIZES OF TUNNEL STIFFENERS SPACED 36 INCHES APART.

Mean Height from Base of Tunnel to Upper Deck.		HEIGHT FROM BASE OF TUNNEL TO TOP OF FLAT SIDE.				
		Feet. 3	Feet. 4	Feet. 5	Feet. 6	
Feet.		inches.	inches.	inches.	inches.	
12	ANGLES ∧	3 × 2½ × ·28	3½ × 3 × ·34	4½ × 3 × ·30	5 × 3 × ·34	ANGLES ∨
16		3½ × 2½ × ·28	4 × 3 × ·36	5 × 3 × ·36	5½ × 3 × ·40	
20		3½ × 3 × ·36	4½ × 3 × ·38	5½ × 3 × ·38	5½ × 3 × ·30	BULB ANGLES ∧
24		4 × 3 × ·32	5 × 3 × ·38	6 × 3 × ·38	6 × 3 × ·32	
28		4 × 3 × ·38	5½ × 3 × ·36	5½ × 3 × ·32	6 × 3 × ·42	
32		4½ × 3 × ·36	6 × 3 × ·34	5½ × 3 × ·40	6½ × 3 × ·42	
36		4½ × 3 × ·40	6 × 3 × ·42	6 × 3 × ·38	7 × 3 × ·40	
40		5 × 3 × ·36	5½ × 3 × ·30	6 × 3 × ·46	7½ × 3 × ·38	
44		5½ × 3 × ·34	5½ × 3 × ·34	6½ × 3 × ·42	7½ × 3 × ·44	
48		5½ × 3 × ·36	5½ × 3 × ·40	7 × 3 × ·38	8 × 3 × ·42	
52		5½ × 3 × ·40	6 × 3 × ·36	7 × 3 × ·42	8½ × 3 × ·40	
56		6 × 3 × ·34	6 × 3 × ·40	7½ × 3 × ·38	8½ × 3 × ·46	
60	ANGLES ∨	6 × 3 × ·38	6½ × 3 × ·34	7½ × 3 × ·42	8½ × 3 × ·50	BULB ANGLES ∨

NOTE.—Angle stiffeners of 6″ in depth and all bulb angle stiffeners are to be connected to the inner bottom plating by a lug.

BEAMS fitted TO EVERY FRAME, with a Steel or Iron Deck.

TABLE **11.**

(See Continuation.)

LENGTH OF BEAM AMIDSHIPS. Feet. Above		not exceeding	UPPER DECK BEAMS IN STEAMERS WHERE ONE TIER OF BEAMS ONLY IS FITTED; FOR SAILING VESSELS, *see* Footnote (*a*). ** *See also* Sec. 47, Par. 7. BEAMS AMIDSHIPS. (For Beams at ends *see* Footnote, Table 13.) 1 With one row of Pillars. Angles. ins. ins. ins.	2 With two rows of Pillars. Angles. ins. ins. ins.	3 With three rows of Pillars. Angles. ins. ins. ins.	Beam Knees fore and aft. *See* also Sec. 20, Pars. 10 & 11. ins. ins.	BEAMS AT UPPER DECKS IN STEAMERS WHERE MORE THAN ONE TIER OF BEAMS ARE FITTED, AT AWNING OR SHELTER DECKS AND AT FORECASTLE DECKS, AND BRIDGE DECKS EXCEEDING ONE-TENTH THE VESSEL'S LENGTH AND POOP DECKS COVERING ENGINE AND BOILER OPENINGS ** BEAMS AMIDSHIPS. (For Beams at ends *see* Footnote, Table 13.) 1 With one row of Pillars. Angles. ins. ins. ins.	2 With two rows of Pillars. Angles. ins. ins. ins.	3 With three rows of Pillars. Angles. ins. ins. ins.	Beam Knees fore and aft. *See* Sec. 20, Par. 10. ins. ins.
16	and	18	$3\frac{1}{2} \times 2\frac{1}{2} \times .30$	$3\frac{1}{2} \times 2\frac{1}{2} \times .30$	$3 \times 2\frac{1}{2} \times .30$	$11 \times .30$				
18	„	20	$4 \times 2\frac{1}{2} \times .30$	$3\frac{1}{2} \times 2\frac{1}{2} \times .30$	$3 \times 2\frac{1}{2} \times .30$	$12 \times .30$				
20	„	22	$4 \times 3 \times .30$	$4 \times 2\frac{1}{2} \times .30$	$3\frac{1}{2} \times 2\frac{1}{2} \times .30$	$13 \times .30$				
22	„	24	$4\frac{1}{2} \times 3 \times .30$	$4 \times 3 \times .30$	$4 \times 2\frac{1}{2} \times .30$	$14 \times .30$				
24	„	26	$5 \times 3 \times .30$	$4\frac{1}{2} \times 3 \times .30$	$4 \times 3 \times .30$	$15 \times .30$	$4\frac{1}{2} \times 3 \times .30$	$4 \times 3 \times .30$	$3\frac{1}{2} \times 2\frac{1}{2} \times .30$	$11 \times .30$
26	„	28	$5 \times 3 \times .34$	$5 \times 3 \times .30$	$4\frac{1}{2} \times 3 \times .30$	$16 \times .30$	$5 \times 3 \times .30$	$4 \times 3 \times .30$	$4 \times 2\frac{1}{2} \times .30$	$12 \times .30$
28	„	30	$5\frac{1}{2} \times 3 \times .34$	$5 \times 3 \times .34$	$5 \times 3 \times .30$	$17 \times .34$	$5 \times 3 \times .34$	$4\frac{1}{2} \times 3 \times .30$	$4 \times 2\frac{1}{2} \times .30$	$12 \times .30$
			Bulb Angles.							
30	„	32	$5\frac{1}{2} \times 3 \times .34$	$5\frac{1}{2} \times 3 \times .34$	$5 \times 3 \times .34$	$18 \times .34$	$5\frac{1}{2} \times 3 \times .34$	$5 \times 3 \times .30$	$4 \times 2\frac{1}{2} \times .30$	$13 \times .30$
				Bulb Angles.						
32	„	34	$6 \times 3 \times .36$	$5\frac{1}{2} \times 3 \times .34$	$5\frac{1}{2} \times 3 \times .34$	$19 \times .40$	$5\frac{1}{2} \times 3 \times .40$	$5 \times 3 \times .34$	$4 \times 3 \times .30$	$13 \times .34$
							Bulb Angles.			
34	„	36	$6\frac{1}{2} \times 3 \times .38$	$6 \times 3 \times .36$	$5\frac{1}{2} \times 3 \times .40$	$20 \times .40$	$5\frac{1}{2} \times 3 \times .34$	$5\frac{1}{2} \times 3 \times .34$	$4\frac{1}{2} \times 3 \times .30$	$14 \times .34$
					Bulb Angles.					
36	„	38	$7 \times 3 \times .40$	$6 \times 3 \times .40$	$5\frac{1}{2} \times 3 \times .34$	$21 \times .40$	$5\frac{1}{2} \times 3 \times .40$	$5\frac{1}{2} \times 3 \times .40$	$5 \times 3 \times .30$	$15 \times .40$
								Bulb Angles.		
38	„	40	$7\frac{1}{2} \times 3 \times .42$	$6\frac{1}{2} \times 3 \times .42$	$5\frac{1}{2} \times 3 \times .40$	$22 \times .42$	$6\frac{1}{2} \times 3 \times .40$	$5\frac{1}{2} \times 3 \times .34$	$5\frac{1}{2} \times 3 \times .30$	$16 \times .40$
40	„	42	$8 \times 3 \times .46$	$7 \times 3 \times .42$	$6 \times 3 \times .40$	$23 \times .46$	$7 \times 3 \times .40$	$5\frac{1}{2} \times 3 \times .40$	$5\frac{1}{2} \times 3 \times .34$	$17 \times .40$
42	„	44	$8\frac{1}{2} \times 3 \times .46$	$7\frac{1}{2} \times 3 \times .42$	$6\frac{1}{2} \times 3 \times .40$	$24 \times .50$	$7\frac{1}{2} \times 3 \times .42$	$6 \times 3 \times .40$	$5\frac{1}{2} \times 3 \times .40$	$18 \times .40$
									Bulb Angles.	
44	„	46		$8 \times 3 \times .44$	$7 \times 3 \times .40$	$25 \times .50$		$6\frac{1}{2} \times 3 \times .40$	$5\frac{1}{2} \times 3 \times .34$	$19 \times .40$
46	„	48		$8\frac{1}{2} \times 3 \times .46$	$7 \times 3 \times .44$	$26 \times .50$		$7 \times 3 \times .40$	$5\frac{1}{2} \times 3 \times .40$	$20 \times .40$
48	„	50		$8\frac{1}{2} \times 3 \times .50$	$7\frac{1}{2} \times 3 \times .44$	$27 \times .50$		$7 \times 3 \times .42$	$6 \times 3 \times .40$	$21 \times .42$
50	„	52			$8 \times 3 \times .44$	$28 \times .50$		$7\frac{1}{2} \times 3 \times .42$	$6\frac{1}{2} \times 3 \times .40$	$22 \times .42$
52	„	54						$8 \times 3 \times .42$	$7 \times 3 \times .40$	$23 \times .42$
54	„	56						$8 \times 3 \times .46$	$7 \times 3 \times .42$	$24 \times .46$
56	„	58						$8\frac{1}{2} \times 3 \times .46$	$7\frac{1}{2} \times 3 \times .42$	$25 \times .46$
58	„	60						$8\frac{1}{2} \times 3\frac{1}{2} \times .48$	$8 \times 3 \times .42$	$26 \times .48$
60	„	62							$8 \times 3 \times .46$	$27 \times .48$
62	„	64							$8\frac{1}{2} \times 3 \times .46$	$28 \times .50$
64	„	66							$8\frac{1}{2} \times 3\frac{1}{2} \times .48$	$29 \times .50$
66	„	68							$9 \times 3\frac{1}{2} \times .48$	$30 \times .50$
68	„	70							$9 \times 3\frac{1}{2} \times .50$	$31 \times .50$
70	„	72							$9\frac{1}{2} \times 3\frac{1}{2} \times .50$	$32 \times .50$
72	„	74							$9\frac{1}{2} \times 3\frac{1}{2} \times .54$	$33 \times .54$
74	„	76							$10 \times 3\frac{1}{2} \times .54$	$34 \times .54$
76	„	78							$10 \times 3\frac{1}{2} \times .58$	$35 \times .58$
78	„	80							$10\frac{1}{2} \times 3\frac{1}{2} \times .58$	$36 \times .58$

(*a*) In sailing vessels where the length of the midship beam does not exceed 30 feet, the upper and lower deck beams are to be ½ inch deeper than given in the Table for upper deck beams of the same length, and where the length is above 30 feet, the upper, lower and orlop deck beams are to be 1 inch deeper than given in the Table for upper deck beams of the same length.

** Where the height between decks exceeds 8 feet 6 inches the size of beams is to be increased.

See footnotes on Table 13.

BEAMS fitted TO EVERY FRAME, with a Steel or Iron Deck. TABLE 11.

(Concluded.)

LENGTH OF BEAM AMIDSHIPS. Feet. Above	not exceeding	ALL TIERS OF BEAMS (IN STEAMERS) BELOW UPPER DECKS NOT FITTED EXCLUSIVELY FOR THE ACCOMMODATION OF PASSENGERS. † ** BEAMS AMIDSHIPS. (For Beams at ends *see* Footnote, Table 13.) 1 With one row of Pillars. Angles. ins. ins. ins.	2 With two rows of Pillars. Angles. ins. ins. ins.	3 With three rows of Pillars. Angles. ins. ins. ins.	Beam Knees fore and aft. *See* Sec. 20, Par. 10. ins.	BEAMS AT BRIDGE DECKS LESS THAN ONE-TENTH THE VESSEL'S LENGTH, AND POOP DECKS NOT COVERING ENGINE AND BOILER OPENINGS. 1 With one row of Pillars. Angles. ins. ins. ins.	2 With two rows of Pillars. Angles. ins. ins. ins.	3 With three rows of Pillars. Angles. ins. ins. ins.	Beam Knees fore and aft. *See* Sec. 20, Par. 10. ins. ins.
16 and	18								
18 „	20								
20 „	22								
22 „	24					3 × 2½ × ·28	3 × 2½ × ·28	3 × 2½ × ·24	8 × ·28
24 „	26	5½ × 3 × ·30	5 × 3 × ·30	4 × 2½ × ·30	13 × ·30	3½ × 2½ × ·28	3½ × 2½ × ·28	3 × 2½ × ·26	9 × ·28
26 „	28	5½ × 3 × ·34	5 × 3 × ·30	4 × 2½ × ·30	13 × ·30	3½ × 2½ × ·30	3½ × 2½ × ·30	3 × 2½ × ·28	9 × ·30
28 „	30	5½ × 3 × ·40	5 × 3 × ·34	4 × 3 × ·30	13 × ·34	4 × 2½ × ·30	3½ × 2½ × ·30	3 × 2½ × ·30	10 × ·30
		Bulb Angles.							
30 „	32	5½ × 3 × ·34	5½ × 3 × ·34	4½ × 3 × ·30	14 × ·34	4 × 3 × ·30	4 × 2½ × ·30	3½ × 2½ × ·30	11 × ·30
32 „	34	5½ × 3 × ·36	5½ × 3 × ·40	5 × 3 × ·30	15 × ·40	4½ × 3 × ·30	4 × 3 × ·30	3½ × 2½ × ·30	11 × ·30
			Bulb Angles.						
34 „	36	6 × 3 × ·36	5½ × 3 × ·34	5½ × 3 × ·30	16 × ·40	5 × 3 × ·30	4 × 3 × ·30	4 × 2½ × ·30	12 × ·30
36 „	38	6½ × 3 × ·38	5½ × 3 × ·40	5½ × 3 × ·34	17 × ·40	5 × 3 × ·34	4½ × 3 × ·30	4 × 2½ × ·30	12 × ·30
38 „	40	7 × 3 × ·40	6 × 3 × ·40	5½ × 3 × ·40	18 × ·40	5½ × 3 × ·34	5 × 3 × ·34	4 × 3 × ·30	13 × ·34
				Bulb Angles.		Bulb Angles.			
40 „	42	7½ × 3 × ·42	6½ × 3 × ·40	5½ × 3 × ·34	19 × ·40	5½ × 3 × ·34	5½ × 3 × ·34	4½ × 3 × ·30	14 × ·34
42 „	44	8 × 3 × ·44	7 × 3 × ·40	5½ × 3 × ·40	20 × ·40	5½ × 3 × ·40	5½ × 3 × ·40	5 × 3 × ·30	15 × ·40
							Bulb Angles.		
44 „	46		7 × 3 × ·42	6 × 3 × ·40	21 × ·42		5½ × 3 × ·34	5½ × 3 × ·30	16 × ·40
46 „	48		7½ × 3 × ·42	6½ × 3 × ·40	22 × ·42		5½ × 3 × ·40	5½ × 3 × ·34	17 × ·40
48 „	50		8 × 3 × ·42	7 × 3 × ·40	23 × ·42		6 × 3 × ·40	5½ × 3 × ·40	18 × ·40
								Bulb Angles.	
50 „	52		8 × 3 × ·44	7 × 3 × ·42	24 × ·46		6½ × 3 × ·40	5½ × 3 × ·34	19 × ·40
52 „	54		8½ × 3 × ·46	7½ × 3 × ·42	25 × ·46		7 × 3 × ·40	5½ × 3 × ·40	20 × ·40
54 „	56		8½ × 3½ × ·48	8 × 3 × ·42	26 × ·48		7 × 3 × ·42	6 × 3 × ·40	21 × ·42
56 „	58		9 × 3½ × ·48	8 × 3 × ·46	27 × ·48		7½ × 3 × ·42	6½ × 3 × ·40	22 × ·42
58 „	60		9 × 3½ × ·50	8½ × 3 × ·46	28 × ·50		8 × 3 × ·42	7 × 3 × ·40	23 × ·42
60 „	62			8½ × 3½ × ·48	29 × ·50			7 × 3 × ·42	24 × ·46
62 „	64			9 × 3½ × ·48	30 × ·50			7½ × 3 × ·42	25 × ·46
64 „	66			9 × 3½ × ·50	31 × ·50			8 × 3 × ·42	26 × ·48
66 „	68			9½ × 3½ × ·50	32 × ·50			8 × 3 × ·46	27 × ·48
68 „	70			9½ × 3½ × ·54	33 × ·54			8½ × 3 × ·46	28 × ·50
70 „	72			10 × 3½ × ·54	34 × ·54			8½ × 3½ × ·48	29 × ·50
72 „	74			10 × 3½ × ·58	35 × ·58			9 × 3½ × ·48	30 × ·50
74 „	76			10½ × 3½ × ·58	36 × ·58			9 × 3½ × ·50	31 × ·50
76 „	78			10½ × 3½ × ·62	37 × ·62			9½ × 3½ × ·50	32 × ·50
78 „	80			11 × 3½ × ·62	38 × ·62			9½ × 3½ × ·54	33 × ·54

† The beams of decks fitted exclusively for the accommodation of passengers and of all tiers in peaks may be of the size given for upper deck beams where more than one tier of beams are fitted.

Beams at the ends of decks below the upper deck less than two-fifths the length of the midship beam may be of the size given for upper deck beams at the ends of the vessel.

** Where the height between decks exceeds 8 feet 6 inches the size of beams is to be increased.

See footnotes on Table 13.

BEAMS fitted TO ALTERNATE FRAMES where no steel or iron deck is fitted.

TABLE **12.**

(See Continuation.)

LENGTH OF BEAM AMIDSHIPS.	UPPER DECK BEAMS IN STEAMERS WHERE ONE TIER OF BEAMS ONLY IS FITTED; FOR SAILING VESSELS, *see* Footnote (*a*)** *See also* Sec. 47, Par. 7.				BEAMS at UPPER DECKS IN STEAMERS WHERE MORE THAN ONE TIER OF BEAMS ARE FITTED, at AWNING OR SHELTER DECKS AND at FORECASTLE DECKS and BRIDGE DECKS EXCEEDING ONE-TENTH THE VESSEL'S LENGTH AND POOP DECKS COVERING ENGINE and BOILER OPENINGS **			
	BEAMS AMIDSHIPS. (*b*) (For Beams at ends, *see* Footnote, Table 13.)			Beam Knees fore and aft. *See* Sec. 20. Par. 10.	BEAMS AMIDSHIPS. (*b*) (For Beams at ends, *see* Footnote, Table 13.)			Beam Knees fore and aft. *See* Sec. 20. Par. 10.
Feet. Above / not exceeding	1 With one row of Pillars.	2 With two rows of Pillars.	3 With three rows of Pillars.		1 With one row of Pillars.	2 With two rows of Pillars.	3 With three rows of Pillars.	
	Angles. ins. ins. ins.	Angles. ins. ins. ins.	Angles. ins. ins. ins.	ins. ins.	Angles. ins. ins. ins.	Angles. ins. ins. ins.	Angles. ins. ins. ins.	ins. ins.
16 and 18	$4\frac{1}{2}\times3\times\cdot34$	$4\frac{1}{2}\times3\times\cdot30$	$4\times3\times\cdot30$	$12\times\cdot30$				
18 „ 20	$5\times3\times\cdot34$	$5\times3\times\cdot34$	$4\frac{1}{2}\times3\times\cdot34$	$13\times\cdot30$				
20 „ 22	$5\frac{1}{2}\times3\times\cdot40$	$5\frac{1}{2}\times3\times\cdot40$	$5\times3\times\cdot40$	$15\times\cdot30$	$5\frac{1}{2}\times3\times\cdot34$	$5\times3\times\cdot34$	$4\frac{1}{2}\times3\times\cdot34$	$14\times\cdot30$
22 „ 24	$5\frac{1}{2}\times3\frac{1}{2}\times\cdot44$	$5\frac{1}{2}\times3\frac{1}{2}\times\cdot40$	$5\frac{1}{2}\times3\times\cdot40$	$16\times\cdot30$	$5\frac{1}{2}\times3\frac{1}{2}\times\cdot40$	$5\frac{1}{2}\times3\times\cdot34$	$4\frac{1}{2}\times3\times\cdot34$	$14\times\cdot30$
24 „ 26	Bulb Plate. $6\times\cdot30$	$6\times3\frac{1}{2}\times\cdot44$	$5\frac{1}{2}\times3\frac{1}{2}\times\cdot44$	$18\times\cdot30$	Bulb Plate. $6\times\cdot26$	$5\frac{1}{2}\times3\frac{1}{2}\times\cdot40$	$5\times3\times\cdot34$	$15\times\cdot30$
26 „ 28	$6\times\cdot34$	Bulb Plate. $6\times\cdot26$	$6\frac{1}{2}\times3\frac{1}{2}\times\cdot44$	$19\times\cdot34$	$6\times\cdot30$	$5\frac{1}{2}\times3\frac{1}{2}\times\cdot44$	$5\frac{1}{2}\times3\times\cdot34$	$15\times\cdot30$
28 „ 30	$7\times\cdot34$	$6\times\cdot30$	Bulb Plate. $6\times\cdot26$	$21\times\cdot34$	$6\times\cdot34$	Bulb Plate. $6\times\cdot26$	$5\frac{1}{2}\times3\times\cdot40$	$16\times\cdot34$
30 „ 32	$7\times\cdot40$	$7\times\cdot30$	$6\times\cdot30$	$22\times\cdot40$	$7\times\cdot30$	$6\times\cdot30$	$5\frac{1}{2}\times3\frac{1}{2}\times\cdot44$	$17\times\cdot34$
32 „ 34	$8\times\cdot40$	$7\times\cdot34$	$6\times\cdot34$	$24\times\cdot40$	$7\times\cdot34$	$6\times\cdot34$	$6\frac{1}{2}\times3\frac{1}{2}\times\cdot44$	$18\times\cdot34$
34 „ 36	$8\times\cdot44$	$7\times\cdot40$	$7\times\cdot30$	$25\times\cdot44$	$7\times\cdot40$	$7\times\cdot30$	Bulb Plate. $6\times\cdot26$	$19\times\cdot40$
36 „ 38	$9\times\cdot44$	$8\times\cdot40$	$7\times\cdot34$	$27\times\cdot44$	$8\times\cdot40$	$7\times\cdot34$	$6\times\cdot30$	$20\times\cdot40$
38 „ 40	$9\times\cdot50$	$8\times\cdot44$	$7\times\cdot40$	$28\times\cdot50$	$8\times\cdot44$	$7\times\cdot40$	$6\times\cdot34$	$21\times\cdot44$
40 „ 42	$10\times\cdot50$	$9\times\cdot44$	$8\times\cdot40$	$30\times\cdot50$	$9\times\cdot44$	$8\times\cdot40$	$7\times\cdot30$	$22\times\cdot44$
42 „ 44	$10\times\cdot54$	$9\times\cdot50$	$8\times\cdot44$	$31\times\cdot54$	$10\times\cdot44$	$8\times\cdot44$	$7\times\cdot34$	$23\times\cdot50$
44 „ 46		$10\times\cdot44$	$9\times\cdot44$	$33\times\cdot54$		$9\times\cdot40$	$7\times\cdot40$	$24\times\cdot50$
46 „ 48		$10\times\cdot50$	$9\times\cdot50$	$34\times\cdot54$		$9\times\cdot44$	$8\times\cdot40$	$25\times\cdot54$
48 „ 50		$10\times\cdot54$	$10\times\cdot44$	$36\times\cdot54$		$10\times\cdot44$	$8\times\cdot44$	$26\times\cdot54$
50 „ 52			$10\times\cdot50$	$37\times\cdot54$		$10\times\cdot50$	$9\times\cdot40$	$27\times\cdot54$
52 „ 54						$10\times\cdot54$	$9\times\cdot44$	$28\times\cdot54$
54 „ 56						$11\times\cdot50$	$9\times\cdot50$	$29\times\cdot54$
56 „ 58							$10\times\cdot44$	$30\times\cdot54$
58 „ 60							$10\times\cdot50$	$31\times\cdot54$
60 „ 62							$10\times\cdot54$	$32\times\cdot54$
62 „ 64							$11\times\cdot50$	$33\times\cdot54$
64 „ 66							$11\times\cdot54$	$34\times\cdot54$

(*a*) In sailing vessels where the length of the midship beam does not exceed 30 feet, the upper and lower deck beams are to be $\frac{1}{2}$ inch deeper than given in the Table for upper deck beams of the same length; and where the length is above 30 feet, the upper, lower, and orlop deck beams are to be 1 inch deeper than given in the Tables for upper deck beams of the same length.

(*b*) Single angles fitted to hatch end beams are to be equivalent to the double angles required by the Rules.

* * Where the height between decks exceeds 8 feet 6 inches the size of beams is to be increased.

See footnotes on Table 13.

BEAMS fitted TO ALTERNATE FRAMES where no steel or iron deck is fitted.

TABLE 12. *(Concluded.)*

LENGTH OF BEAM AMIDSHIPS. Feet. Above / not exceeding	ALL TIERS OF BEAMS (IN STEAMERS) BELOW UPPER DECKS NOT FITTED EXCLUSIVELY FOR THE ACCOMMODATION OF PASSENGERS.†** BEAMS AMIDSHIPS. (*b*) (For Beams at ends *see* Footnote, Table 13.) 1 With one row of Pillars. Angles. ins. ins.	2 With two rows of Pillars. Angles. ins. ins.	3 With three rows of Pillars. Angles. ins. ins. ins.	Beam Knees fore and aft. *See* Sec. 20. Par. 10. ins. ins.	BEAMS at BRIDGE DECKS LESS THAN ONE TENTH THE VESSEL'S LENGTH, and POOP DECKS NOT COVERING ENGINE and BOILER OPENINGS. 1 With one row of Pillars. Angles. ins. ins. ins.	2 With two rows of Pillars. Angles. ins. ins. ins.	3 With three rows of Pillars. Angles. ins. ins. ins.	Beam Knees fore and aft. *See* Sec. 20. Par. 10. ins. ins.	"STRONG" HOLD BEAMS (*c*) Plate. ins. ins.	Double Angles on top and bottom edges. ins. ins. ins.	Beam Knees fore and aft. *See* Sec. 20. Par. 10. ins. ins.
16 and 18					$4\frac{1}{2}\times3\times\cdot30$	$4\frac{1}{2}\times3\times\cdot30$	$4\times3\times\cdot30$	$11\times\cdot30$			
18 „ 20											
20 „ 22											
22 „ 24											
24 „ 26	Bulb Plate. $7\times\cdot30$	Bulb Plate. $6\times\cdot30$	$5\frac{1}{2}\times3\frac{1}{2}\times\cdot44$	$17\times\cdot34$	$4\frac{1}{2}\times3\times\cdot34$	$4\frac{1}{2}\times3\times\cdot34$	$4\times3\times\cdot34$	$11\times\cdot30$	$7\times\cdot34$	$3\times3\times\cdot30$	$21\times\cdot40$
26 „ 28	$7\times\cdot34$	$6\times\cdot34$	$6\frac{1}{2}\times3\frac{1}{2}\times\cdot44$	$18\times\cdot34$	$5\times3\times\cdot34$	$4\frac{1}{2}\times3\times\cdot34$	$4\times3\times\cdot34$	$12\times\cdot30$	$7\frac{1}{2}\times\cdot34$	$3\times3\times\cdot34$	$22\times\cdot44$
28 „ 30	$7\times\cdot40$	$7\times\cdot30$	Bulb Plate. $6\times\cdot26$	$19\times\cdot40$	$5\frac{1}{2}\times3\times\cdot34$	$5\times3\times\cdot34$	$4\frac{1}{2}\times3\times\cdot34$	$12\times\cdot30$	$8\times\cdot40$	$3\frac{1}{2}\times3\times\cdot34$	$23\times\cdot44$
30 „ 32	$8\times\cdot40$	$7\times\cdot34$	$6\times\cdot30$	$20\times\cdot40$	$5\frac{1}{2}\times3\times\cdot40$	$5\frac{1}{2}\times3\times\cdot34$	$4\frac{1}{2}\times3\times\cdot34$	$13\times\cdot30$	$8\frac{1}{2}\times\cdot40$	$4\times3\times\cdot34$	$24\times\cdot44$
32 „ 34	$8\times\cdot44$	$7\times\cdot40$	$6\times\cdot34$	$21\times\cdot44$	$5\frac{1}{2}\times3\frac{1}{2}\times\cdot44$	$5\frac{1}{2}\times3\times\cdot40$	$5\times3\times\cdot34$	$14\times\cdot30$	$9\times\cdot44$	$4\times4\times\cdot34$	$25\times\cdot50$
34 „ 36	$9\times\cdot44$	$8\times\cdot40$	$7\times\cdot30$	$22\times\cdot44$	Bulb Plate. $6\times\cdot30$	$5\frac{1}{2}\times3\frac{1}{2}\times\cdot44$	$5\frac{1}{2}\times3\times\cdot34$	$15\times\cdot30$	$9\frac{1}{2}\times\cdot44$	$4\times4\times\cdot40$	$26\times\cdot50$
36 „ 38	$10\times\cdot44$	$8\times\cdot44$	$7\times\cdot34$	$23\times\cdot50$	$6\times\cdot34$	Bulb Plate. $6\times\cdot26$	$5\frac{1}{2}\times3\times\cdot40$	$16\times\cdot34$	$10\times\cdot50$	$4\times4\times\cdot44$	$27\times\cdot50$
38 „ 40	$10\times\cdot50$	$9\times\cdot40$	$7\times\cdot40$	$24\times\cdot50$	$7\times\cdot34$	$6\times\cdot34$	$5\frac{1}{2}\times3\frac{1}{2}\times\cdot44$	$18\times\cdot34$	$10\times\cdot54$	$4\times4\times\cdot44$	$28\times\cdot54$
40 „ 42	$10\times\cdot54$	$9\times\cdot44$	$8\times\cdot40$	$25\times\cdot54$	$7\times\cdot40$	$7\times\cdot30$	Bulb Plate. $6\times\cdot26$	$19\times\cdot40$	$11\times\cdot54$	$4\times4\times\cdot44$	$29\times\cdot54$
42 „ 44	$11\times\cdot54$	$10\times\cdot44$	$8\times\cdot44$	$26\times\cdot54$	$8\times\cdot40$	$7\times\cdot34$	$6\times\cdot30$	$20\times\cdot40$	$11\frac{1}{2}\times\cdot54$	$5\times4\times\cdot44$	$30\times\cdot54$
44 „ 46		$10\times\cdot50$	$9\times\cdot40$	$27\times\cdot54$		$7\times\cdot40$	$6\times\cdot34$	$21\times\cdot40$	$12\times\cdot54$	$5\times4\times\cdot44$	$31\times\cdot54$
46 „ 48		$10\times\cdot54$	$9\times\cdot44$	$28\times\cdot54$		$8\times\cdot40$	$7\times\cdot30$	$22\times\cdot44$	$12\times\cdot60$	$5\times4\times\cdot44$	$32\times\cdot60$
48 „ 50		$11\times\cdot50$	$9\times\cdot50$	$29\times\cdot54$		$8\times\cdot44$	$7\times\cdot34$	$23\times\cdot44$	$12\times\cdot60$	$6\times4\times\cdot50$	$33\times\cdot60$
50 „ 52		$11\times\cdot54$	$10\times\cdot44$	$30\times\cdot54$		$9\times\cdot40$	$7\times\cdot40$	$24\times\cdot50$	$13\times\cdot60$	$6\times4\times\cdot50$	$34\times\cdot60$
52 „ 54		$12\times\cdot50$	$10\times\cdot50$	$31\times\cdot54$		$9\times\cdot44$	$8\times\cdot40$	$25\times\cdot54$	$13\times\cdot60$	$6\frac{1}{2}\times4\times\cdot50$	$35\times\cdot60$
54 „ 56		$12\times\cdot54$	$10\times\cdot54$	$32\times\cdot54$		$9\times\cdot50$	$8\times\cdot44$	$26\times\cdot54$	$13\times\cdot60$	$6\frac{1}{2}\times4\frac{1}{2}\times\cdot50$	$36\times\cdot60$
56 „ 58			$11\times\cdot50$	$33\times\cdot54$			$9\times\cdot40$	$27\times\cdot54$	$13\times\cdot60$	$6\frac{1}{2}\times4\frac{1}{2}\times\cdot54$	$37\times\cdot60$
58 „ 60			$11\times\cdot54$	$34\times\cdot54$			$9\times\cdot44$	$28\times\cdot54$	$14\times\cdot60$	$6\frac{1}{2}\times4\frac{1}{2}\times\cdot54$	$38\times\cdot60$
60 „ 62			$12\times\cdot50$	$35\times\cdot54$			$9\times\cdot50$	$29\times\cdot54$	$14\times\cdot60$	$6\frac{1}{2}\times4\frac{1}{2}\times\cdot54$	$39\times\cdot60$
62 „ 64			$12\times\cdot54$	$36\times\cdot54$			$10\times\cdot44$	$30\times\cdot54$	$14\times\cdot64$	$6\frac{1}{2}\times4\frac{1}{2}\times\cdot60$	$40\times\cdot64$
64 „ 66			$12\times\cdot60$	$37\times\cdot60$			$10\times\cdot50$	$31\times\cdot54$	$15\times\cdot64$	$6\frac{1}{2}\times4\frac{1}{2}\times\cdot60$	$42\times\cdot64$

† The beams of decks fitted exclusively for the accommodation of passengers and of all tiers in peaks may be of the size given for upper deck beams where more than one tier of beams are fitted.

Beams at the ends of decks below the upper deck, less than two-fifths the length of the midship beam, may be of the size given for upper deck beams at the ends of the vessel.

** Where the height between decks exceeds 8 feet 6 inches the size of beams is to be increased.

(*b*) Single angles fitted to hatch end beams are to be equivalent to the double angles required by the Rules.

(*c*) These beams are to be formed of a plate with double angle bars on the upper and lower edges. The beam plates and angle bars are to be of the sizes given above, and the broad flanges of the angle bars are to be fitted horizontally. Semi-box beams may be adopted in lieu thereof, formed of bulb plate and single angle bars of the sizes given for upper deck beams, kneed to two consecutive frames with a covering plate of the thickness of the angles.

Strong beams in the machinery space are to have double angles on their upper and lower edges, unless cross tie plating is fitted on them, in which case only single angles need be fitted to the upper and lower edges.

See Footnotes on Table 13.

TABLE 13.

EQUIVALENT BEAMS fitted TO ALTERNATE FRAMES.

BEAMS OF BULB PLATE, AS PER TABLE 12, AND DOUBLE ANGLES.		EQUIVALENT BULB TEE OR BULB ANGLE BEAMS WHERE NO STEEL OR IRON DECK IS FITTED.		EQUIVALENT BULB PLATE AND DOUBLE ANGLES, BULB TEE, CHANNEL OR BULB ANGLE BEAMS WHERE A STEEL OR IRON DECK IS FITTED.				
Bulb Plate. ins.	Double Angles. ins. ins. ins.	Bulb Tee Beams. ins. ins. ins.	Bulb Angles.* ins. ins. ins.	Bulb Plate. ins.	Double Angles. ins. ins. ins.	Bulb Tee Beams. ins. ins. ins.	Channel Beams. ins. ins. ins. ins.	Bulb Angles. ins. ins. ins.
6 × ·26	2½ × 2½ × ·24		6½ × 3 × ·40					6 × 3 × ·40
6 × ·30	2½ × 2½ × ·24		6½ × 3 × ·44					6½ × 3 × ·40
6 × ·34	2½ × 2½ × ·30		7 × 3 × ·44	6 × ·26	2½ × 2½ × ·24			7 × 3 × ·42
7 × ·30	3 × 2½ × ·30		7½ × 3 × ·46	6 × ·30	2½ × 2½ × ·24			7½ × 3 × ·42
7 × ·34	3 × 2½ × ·30	7 × 5 × ·34	7½ × 3 × ·50	6 × ·34	2½ × 2½ × ·30			8 × 3 × ·42
7 × ·40	3 × 3 × ·30	7 × 5 × ·40	8½ × 3 × ·50	7 × ·30	3 × 2½ × ·30			8 × 3 × ·46
8 × ·40	3 × 3 × ·30	8 × 5½ × ·40	9 × 3½ × ·50	7 × ·34	3 × 2½ × ·30	7 × 5 × ·34	7 × 3 × 3 × ·40	8½ × 3 × ·46
8 × ·44	3 × 3 × ·34	8 × 5½ × ·44		7 × ·40	3 × 3 × ·30	7 × 5 × ·40	7½ × 3 × 3 × ·40	8½ × 3 × ·48
9 × ·40	3½ × 3 × ·34	9 × 5½ × ·40		8 × ·36	3 × 3 × ·30	8 × 5½ × ·36	7½ × 3 × 3 × ·42	8½ × 3½ × ·50
9 × ·44	3½ × 3 × ·34	9 × 5½ × ·44		8 × ·40	3 × 3 × ·30	8 × 5½ × ·40	7½ × 3½ × 3½ × ·44	9 × 3½ × ·50
9 × ·50	3½ × 3½ × ·34	9 × 5½ × ·50		8 × ·44	3 × 3 × ·34	8 × 5½ × ·44	8 × 3½ × 3½ × ·44	9½ × 3½ × ·52
10 × ·44	3½ × 3½ × ·34	10 × 6 × ·44		9 × ·40	3½ × 3 × ·34	9 × 5½ × ·40	8½ × 3½ × 3½ × ·46	9½ × 3½ × ·56
10 × ·50	3½ × 3½ × ·34	10 × 6 × ·50		9 × ·44	3½ × 3 × ·34	9 × 5½ × ·44	8½ × 3½ × 3½ × ·50	10 × 3½ × ·56
10 × ·54	3½ × 3½ × ·40	10 × 6 × ·54		9 × ·50	3½ × 3½ × ·34	9 × 5½ × ·50	9 × 3½ × 3½ × ·48	10½ × 3½ × ·56
11 × ·50	3½ × 3½ × ·40	11 × 6½ × ·50		10 × ·44	3½ × 3½ × ·34	10 × 6 × ·44	10 × 3½ × 3½ × ·48	11 × 3½ × ·56
11 × ·54	3½ × 3½ × ·40	11 × 6½ × ·54		10 × ·50	3½ × 3½ × ·34	10 × 6 × ·50	10½ × 3½ × 3½ × ·48	11 × 3½ × ·62
12 × ·50	3½ × 3½ × ·44	12 × 6½ × ·50		10 × ·54	3½ × 3½ × ·40	10 × 6 × ·54	11 × 3½ × 3½ × ·52	11½ × 3½ × ·62
12 × ·54	3½ × 3½ × ·44	12 × 6½ × ·54		11 × ·50	3½ × 3½ × ·40	11 × 6½ × ·50	11½ × 3½ × 3½ × ·52	12 × 4 × ·62
12 × ·60	3½ × 3½ × ·44	12 × 6½ × ·60		11 × ·54	3½ × 3½ × ·40	11 × 6½ × ·54	12 × 4 × 4 × ·52	

EQUIVALENT BEAMS fitted TO EVERY FRAME.

BEAMS OF BULB ANGLE, AS PER TABLE 11.	EQUIVALENT CHANNEL BEAMS FITTED TO EVERY FRAME WITH A STEEL OR IRON DECK.
Bulb Angles. ins. ins. ins.	Channel Beams. ins. ins. ins. ins.
8 × 3 × ·42	7 × 3 × 3 × ·38
8 × 3 × ·46	7 × 3 × 3 × ·40
8½ × 3 × ·46	7½ × 3 × 3 × ·40
8½ × 3½ × ·48	7½ × 3½ × 3½ × ·42
9 × 3½ × ·48	8 × 3½ × 3½ × ·42
9 × 3½ × ·50	8 × 3½ × 3½ × ·44
9½ × 3½ × ·50	8½ × 3½ × 3½ × ·44
9½ × 3½ × ·54	8½ × 3½ × 3½ × ·48
10 × 3½ × ·54	9 × 3½ × 3½ × ·48
10 × 3½ × ·58	9 × 3½ × 3½ × ·50
10½ × 3½ × ·58	10 × 3½ × 3½ × ·50
10½ × 3½ × ·62	10½ × 3½ × 3½ × ·52
11 × 3½ × ·62	11 × 3½ × 3½ × ·52

Where *one row of pillars* is fitted, the *beams at the ends* of a vessel which do not exceed in length two-thirds that of the beam amidships, may be of the size required by the columns numbered 2 in Tables 11 and 12; and beams at ends which do not exceed half the length of the beam amidships may be of the size required by columns 3 in Tables 11 and 12.

Where *two rows of pillars* are fitted amidships, the athwartship distance between the rows is to be about one-third the breadth of the vessel amidships; and the *beams at the ends* which do not exceed two-thirds the length of the beam amidships, may be supported by one row of pillars, and be of the size required by columns 2, and where the lengths of the *beams at the ends* do not exceed half the midship beam length the size may be as required by columns 3, if supported by one row of pillars.

Where *three rows of pillars* are fitted amidships, the athwartship distances between the rows of pillars is to be about one-fourth the breadth of the vessel amidships, and the beams throughout are to be of the size required for beams amidships by columns 3; but where the lengths of the beams do not exceed three-fourths the length of the beam amidships, two rows of pillars may be fitted; and where the *beams at the ends* do not exceed half the midship beam length, one row of pillars may be fitted.

LLOYD'S REGISTER OF SHIPPING, LONDON.—*11th May, 1911.*

Diameters of SOLID PILLARS of IRON or STEEL fitted TWO FRAME SPACES APART.

TABLE **14.**

(See Continuation.)

LENGTH OF PILLAR. Feet.	PILLARS TO BEAMS OF UPPER DECK.																			PILLARS TO BEAMS OF SECOND DECK.																		
	One row of Pillars.							Two rows of Pillars.					Three rows of Pillars.							One row of Pillars.					Two rows of Pillars.					Three rows of Pillars.								
	LENGTHS OF BEAMS AMIDSHIPS IN FEET.																			LENGTHS OF BEAMS AMIDSHIPS IN FEET.																		
	15	19	23	27	31	35	39	44	47	51	55	59	55	59	63	67	71	75	79	23	27	31	35	39	44	47	51	55	59	55	59	63	67	71	75	79			
Above 6 and not exceeding 8	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.			
	$2\frac{1}{4}$	$2\frac{1}{4}$	$2\frac{3}{8}$	$2\frac{3}{8}$	$2\frac{1}{2}$	$2\frac{5}{8}$	$2\frac{3}{4}$	$2\frac{5}{8}$	$2\frac{3}{4}$	$2\frac{7}{8}$	3	$3\frac{1}{8}$	$2\frac{3}{4}$	$2\frac{7}{8}$	3	$3\frac{1}{8}$	$3\frac{1}{4}$	$3\frac{3}{8}$	$3\frac{1}{2}$	$2\frac{7}{8}$	3	$3\frac{1}{8}$	$3\frac{1}{4}$	$3\frac{3}{8}$	$3\frac{1}{8}$	$3\frac{1}{4}$	$3\frac{3}{8}$	$3\frac{1}{2}$	$3\frac{5}{8}$	$3\frac{1}{4}$	$3\frac{3}{8}$	$3\frac{1}{2}$	$3\frac{5}{8}$	$3\frac{3}{4}$	$3\frac{7}{8}$	4		
8 „ 10	$2\frac{3}{8}$	$2\frac{3}{8}$	$2\frac{1}{2}$	$2\frac{1}{2}$	$2\frac{5}{8}$	$2\frac{3}{4}$	$2\frac{7}{8}$	$2\frac{3}{4}$	$2\frac{7}{8}$	3	$3\frac{1}{8}$	$3\frac{1}{4}$	$2\frac{7}{8}$	3	$3\frac{1}{8}$	$3\frac{1}{4}$	$3\frac{3}{8}$	$3\frac{1}{2}$	$3\frac{5}{8}$	3	$3\frac{1}{8}$	$3\frac{1}{4}$	$3\frac{1}{2}$	$3\frac{5}{8}$	$3\frac{3}{8}$	$3\frac{1}{2}$	$3\frac{5}{8}$	$3\frac{3}{4}$	$3\frac{7}{8}$	$3\frac{1}{2}$	$3\frac{5}{8}$	$3\frac{3}{4}$	$3\frac{7}{8}$	4	4	$4\frac{1}{4}$		
10 „ 12	$2\frac{1}{2}$	$2\frac{1}{2}$	$2\frac{5}{8}$	$2\frac{3}{4}$	$2\frac{3}{4}$	$2\frac{7}{8}$	3	$2\frac{7}{8}$	3	$3\frac{1}{8}$	$3\frac{1}{4}$	$3\frac{3}{8}$	3	$3\frac{1}{8}$	$3\frac{1}{4}$	$3\frac{3}{8}$	$3\frac{1}{2}$	$3\frac{5}{8}$	$3\frac{3}{4}$	$3\frac{1}{4}$	$3\frac{3}{8}$	$3\frac{1}{2}$	$3\frac{3}{4}$	$3\frac{7}{8}$	$3\frac{5}{8}$	$3\frac{3}{4}$	$3\frac{7}{8}$	4	$4\frac{1}{4}$	$3\frac{3}{4}$	$3\frac{7}{8}$	4	4	$4\frac{1}{4}$	$4\frac{1}{4}$	$4\frac{1}{2}$		
12 „ 14	$2\frac{5}{8}$	$2\frac{3}{4}$	$2\frac{7}{8}$	3	3	$3\frac{1}{8}$	$3\frac{1}{4}$	3	$3\frac{1}{8}$	$3\frac{1}{4}$	$3\frac{3}{8}$	$3\frac{1}{2}$									$3\frac{5}{8}$	$3\frac{3}{4}$	4	$4\frac{1}{4}$	$3\frac{7}{8}$	4	$4\frac{1}{4}$	$4\frac{1}{4}$	$4\frac{1}{2}$	4								
14 „ 16		$2\frac{7}{8}$	3	$3\frac{1}{8}$	$3\frac{1}{4}$	$3\frac{3}{8}$	$3\frac{1}{2}$	$3\frac{1}{4}$	$3\frac{3}{8}$	$3\frac{1}{2}$	$3\frac{5}{8}$	$3\frac{3}{4}$									4	$4\frac{1}{4}$	$4\frac{1}{2}$	4	$4\frac{1}{4}$	$4\frac{1}{2}$	$4\frac{1}{2}$	$4\frac{3}{4}$	$4\frac{1}{4}$									
16 „ 18			$3\frac{1}{4}$	$3\frac{3}{8}$	$3\frac{1}{2}$	$3\frac{5}{8}$	$3\frac{3}{4}$	$3\frac{1}{2}$	$3\frac{5}{8}$	$3\frac{3}{4}$	$3\frac{7}{8}$	4									$4\frac{1}{4}$	$4\frac{1}{2}$	$4\frac{3}{4}$	$4\frac{1}{4}$	$4\frac{1}{2}$	$4\frac{3}{4}$	$4\frac{3}{4}$	5	$4\frac{1}{4}$									
18 „ 20			$3\frac{1}{2}$	$3\frac{5}{8}$	$3\frac{3}{4}$	$3\frac{7}{8}$	4	$3\frac{3}{4}$	$3\frac{7}{8}$	4	4	$4\frac{1}{4}$									$4\frac{3}{4}$	5	$4\frac{1}{2}$	$4\frac{3}{4}$	$4\frac{3}{4}$	5	$5\frac{1}{4}$	$4\frac{1}{2}$									
20 „ 22				$3\frac{3}{4}$	$3\frac{7}{8}$	4	$4\frac{1}{4}$	$3\frac{7}{8}$	4	$4\frac{1}{4}$	$4\frac{1}{4}$	$4\frac{1}{2}$									5	$5\frac{1}{4}$	$4\frac{3}{4}$	5	5	$5\frac{1}{4}$	$5\frac{1}{2}$	$4\frac{3}{4}$									
22 „ 24				4	4	$4\frac{1}{4}$	$4\frac{1}{2}$	4	$4\frac{1}{4}$	$4\frac{1}{2}$	$4\frac{1}{2}$	$4\frac{3}{4}$										$5\frac{1}{2}$	5	$5\frac{1}{4}$	$5\frac{1}{4}$	$5\frac{1}{2}$	$5\frac{3}{4}$	5									
24 „ 26					$4\frac{1}{4}$	$4\frac{1}{2}$	$4\frac{3}{4}$	$4\frac{1}{4}$	$4\frac{1}{2}$	$4\frac{3}{4}$	$4\frac{3}{4}$	5											$5\frac{1}{4}$	$5\frac{1}{2}$	$5\frac{1}{2}$	$5\frac{3}{4}$	6	$5\frac{1}{4}$									
26 „ 28						$4\frac{3}{4}$	5	$4\frac{1}{2}$	$4\frac{3}{4}$	5	5	$5\frac{1}{4}$											$5\frac{1}{2}$	$5\frac{3}{4}$	$5\frac{3}{4}$	6	$6\frac{1}{4}$	$5\frac{1}{2}$									
28 „ 30							$5\frac{1}{4}$	$4\frac{3}{4}$	5	$5\frac{1}{4}$	$5\frac{1}{4}$	$5\frac{1}{2}$											$5\frac{3}{4}$	6	6	$6\frac{1}{4}$	$6\frac{1}{2}$	$5\frac{3}{4}$									
30 „ 32								5	$5\frac{1}{4}$	$5\frac{1}{2}$	$5\frac{1}{2}$	$5\frac{3}{4}$																										
	PILLARS TO AWNING, SHELTER, BRIDGE, FORECASTLE, AND POOP DECK BEAMS.																																						
6 „ 8	$2\frac{1}{8}$	$2\frac{1}{8}$	$2\frac{1}{4}$	$2\frac{1}{4}$	$2\frac{3}{8}$	$2\frac{1}{2}$	$2\frac{5}{8}$	$2\frac{1}{2}$	$2\frac{5}{8}$	$2\frac{3}{4}$	$2\frac{7}{8}$	3	$2\frac{5}{8}$	$2\frac{3}{4}$	$2\frac{7}{8}$	3	$3\frac{1}{8}$	$3\frac{1}{4}$	$3\frac{3}{8}$																			

EQUIVALENT PILLARS OF IRON OR STEEL.

Solid Pillars, as per Table 14. Diameter.	inches. $2\frac{1}{8}$	inches. $2\frac{1}{4}$	inches. $2\frac{3}{8}$	inches. $2\frac{1}{2}$	inches. $2\frac{5}{8}$	inches. $2\frac{3}{4}$	inches. $2\frac{7}{8}$	inches. 3	inches. $3\frac{1}{8}$	inches. $3\frac{1}{4}$	inches. $3\frac{3}{8}$	inches. $3\frac{1}{2}$	inches. $3\frac{5}{8}$
Equivalent Hollow Pillars. Diameter and Thickness.*	$2\frac{1}{2} \times \frac{5}{16}$	$2\frac{3}{4} \times \frac{5}{16}$	$3 \times \frac{5}{16}$	$3 \times \frac{6}{16}$	$3\frac{1}{4} \times \frac{6}{16}$	$3\frac{1}{2} \times \frac{6}{16}$	$3\frac{3}{4} \times \frac{6}{16}$	$4 \times \frac{7}{16}$	$4\frac{1}{4} \times \frac{7}{16}$	$4\frac{1}{2} \times \frac{7}{16}$	$4\frac{3}{4} \times \frac{7}{16}$	$5 \times \frac{7}{16}$	$5\frac{1}{2} \times \frac{7}{16}$

Solid Pillars, as per Table 14. Diameter.	inches. $3\frac{3}{4}$	inches. $3\frac{7}{8}$	in hes. 4	inches. $4\frac{1}{4}$	inches. $4\frac{1}{2}$	inches. $4\frac{3}{4}$	inches. 5	inches. $5\frac{1}{4}$	inches. $5\frac{1}{2}$	inches. $5\frac{3}{4}$	inches. 6	inches. $6\frac{1}{4}$	inches. $6\frac{1}{2}$	inches. $6\frac{3}{4}$
Equivalent Hollow Pillars. Diameter and Thickness.*	$5\frac{3}{4} \times \frac{8}{16}$	$6 \times \frac{8}{16}$	$6 \times \frac{9}{16}$	$6\frac{1}{4} \times \frac{9}{16}$	$6\frac{1}{2} \times \frac{9}{16}$	$6\frac{3}{4} \times \frac{9}{16}$	$7 \times \frac{9}{16}$	$7 \times \frac{10}{16}$	$7\frac{1}{2} \times \frac{10}{16}$	$7\frac{3}{4} \times \frac{10}{16}$	$8\frac{1}{2} \times \frac{10}{16}$	$8\frac{1}{2} \times \frac{11}{16}$	$8\frac{3}{4} \times \frac{11}{16}$	$9 \times \frac{11}{16}$

The hollow pillars required by the above Table are to have solid welded heads and heels.

WIDELY SPACED STEEL PILLARS. TABLE 15.

(For above 22 feet, see continuation.)

NUMBERS.* $\frac{S \times B \times H}{100}$	LENGTH AND FORM OF PILLAR.							
	Above 18 feet and not exceeding 20 feet.				Above 20 feet and not exceeding 22 feet.			
	TUBULAR. ○	DOUBLE CHANNELS AND FACE PLATES. I		FOUR ANGLES. +	TUBULAR. ○	DOUBLE CHANNELS AND FACE PLATES. I		FOUR ANGLES. +
	Outside diameter.	Channels.	Plates.		Outside diameter.	Channels.	Plates.	
Above and not exceeding	inches.	inches.	inches.	inches.	inches.	inches.	inches.	inches.
11 and 13	8 ×·40	8 ×4 ×4 ×·54		$4\frac{1}{2} \times 4\frac{1}{2} \times ·40$	$8\frac{1}{2} \times ·40$	8 ×4 ×4 ×·62		$4\frac{1}{2} \times 4\frac{1}{2} \times ·44$
13 „ 16	$8\frac{1}{2} \times ·40$	8 ×4 ×4 ×·62		$4\frac{1}{2} \times 4\frac{1}{2} \times ·44$	9 ×·40	9 ×4 ×4 ×·62		5 ×5 ×·40
16 „ 19	9 ×·40	9 ×4 ×4 ×·62		5 ×5 ×·40	9 ×·44	9 ×4 ×4 ×·66		5 ×5 ×·44
19 „ 22	9 ×·44	9 ×4 ×4 ×·66		5 ×5 ×·44	10 ×·40	$8\frac{1}{2} \times 3\frac{1}{2} \times 3\frac{1}{2} \times ·44$	9×·40	5 ×5 ×·50
22 „ 25	10 ×·40	$8\frac{1}{2} \times 3\frac{1}{2} \times 3\frac{1}{2} \times ·44$	9×·40	5 ×5 ×·50	10 ×·40	$8\frac{1}{2} \times 3\frac{1}{2} \times 3\frac{1}{2} \times ·46$	10×·40	5 ×5 ×·54
25 „ 29	10 ×·44	$8\frac{1}{2} \times 3\frac{1}{2} \times 3\frac{1}{2} \times ·46$	10×·40	5 ×5 ×·54	10 ×·44	9 ×$3\frac{1}{2} \times 3\frac{1}{2} \times ·46$	10×·40	5 ×5 ×·54
29 „ 33	10 ×·50	9 ×$3\frac{1}{2} \times 3\frac{1}{2} \times ·46$	10×·40	5 ×5 ×·60	10 ×·50	9 ×$3\frac{1}{2} \times 3\frac{1}{2} \times ·46$	10×·40	5 ×5 ×·60
33 „ 37	11 ×·50	$9\frac{1}{2} \times 3\frac{1}{2} \times 3\frac{1}{2} \times ·48$	10×·42	6 ×6 ×·50	11 ×·50	$9\frac{1}{2} \times 3\frac{1}{2} \times 3\frac{1}{2} \times ·48$	10×·42	6 ×6 ×·50
37 „ 42	12 ×·50	10 ×$3\frac{1}{2} \times 3\frac{1}{2} \times ·48$	11×·42	6 ×6 ×·54	12 ×·50	10 ×$3\frac{1}{2} \times 3\frac{1}{2} \times ·48$	11×·42	6 ×6 ×·54
42 „ 47	12 ×·54	11 ×$3\frac{1}{2} \times 3\frac{1}{2} \times ·48$	11×·46	6 ×6 ×·60	12 ×·54	11 ×$3\frac{1}{2} \times 3\frac{1}{2} \times ·48$	11×·46	6 ×6 ×·60
47 „ 52	13 ×·54	11 ×$3\frac{1}{2} \times 3\frac{1}{2} \times ·48$	12×·50	6 ×6 ×·64	13 ×·54	11 ×$3\frac{1}{2} \times 3\frac{1}{2} \times ·48$	12×·50	6 ×6 ×·64
52 „ 58	13 ×·60	11 ×$3\frac{1}{2} \times 3\frac{1}{2} \times ·50$	12×·56	6 ×6 ×·70	13 ×·60	11 ×$3\frac{1}{2} \times 3\frac{1}{2} \times ·50$	12×·56	6 ×6 ×·70
58 „ 64	14 ×·60	11 ×$3\frac{1}{2} \times 3\frac{1}{2} \times ·50$	12×·60	7 ×7 ×·60	14 ×·60	11 ×$3\frac{1}{2} \times 3\frac{1}{2} \times ·50$	12×·60	7 ×7 ×·60
64 „ 71	15 ×·60	$11\frac{1}{2} \times 3\frac{1}{2} \times 3\frac{1}{2} \times ·50$	13×·60	7 ×7 ×·64	15 ×·60	$11\frac{1}{2} \times 3\frac{1}{2} \times 3\frac{1}{2} \times ·50$	13×·60	7 ×7 ×·64
71 „ 78	16 ×·60	12 ×$3\frac{1}{2} \times 3\frac{1}{2} \times ·50$	13×·70	7 ×7 ×·70	16 ×·60	12 ×$3\frac{1}{2} \times 3\frac{1}{2} \times ·50$	13×·70	7 ×7 ×·70
78 „ 86	17 ×·60	12 ×$3\frac{1}{2} \times 3\frac{1}{2} \times ·50$	13×·74	7 ×7 ×·74	17 ×·60	12 ×$3\frac{1}{2} \times 3\frac{1}{2} \times ·50$	13×·74	7 ×7 ×·74
86 „ 94	18 ×·60	12 ×4 ×4 ×·60	13×·74	7 ×7 ×·80	18 ×·60	12 ×4 ×4 ×·60	13×·74	7 ×7 ×·80
94 „ 102	18 ×·64	12 ×4 ×4 ×·70	13×·74	7 ×7 ×·84	18 ×·64	12 ×4 ×4 ×·70	13×·74	7 ×7 ×·84
102 „ 110	18 ×·70	12 ×4 ×4 ×·72	14×·80	8 ×8 ×·80	18 ×·70	12 ×4 ×4 ×·72	14×·80	8 ×8 ×·80
110 „ 118	18 ×·74			8 ×8 ×·84	18 ×·74			8 ×8 ×·84
118 „ 126								
126 „ 134								

6. Arrangements are to be made at the various decks in order to secure an efficient distribution of the support afforded by the pillars. Arrangements are also to be made at the heels of the pillars to secure an effective distribution of the load carried over the adjacent structure. As far as possible the pillars are to be stepped on the tank top at the intersection of a floor and of an intercostal; where this cannot be done partial floors and intercostals are to be fitted. No manholes are to be cut in the floors and intercostals in way of the heels of the pillars.

7. For some methods of attaching the pillars at heads and heels, *see* Sketches on pages 168 and 169.

8. When widely spaced pillars are fitted in accordance with the requirements of the above Table, they are to be of steel having a tensile strength of from 28 to 32 tons per square inch (as per Section 3). If steel of from 22 to 27 tons per square inch tensile strength be used for widely spaced hollow round pillars, the plates from which the pillars are to be made must be increased in thickness as follows:—

Thickness required by above Table for steel of from 28 to 32 tons per sq. inch tensile strength.	in. ·40	in. ·44	in. ·50	in. ·54	in. ·60	in. ·64	in. ·70	in. ·74
Equivalent thickness when steel of from 22 to 27 tons per sq. inch tensile strength is used for hollow pillars.	·48	·52	·60	·64	·72	·76	·82	·88

WIDELY SPACED STEEL PILLARS. TABLE 15.

(For above 26 feet, see continuation.)

NUMBERS.* $\frac{S \times B \times H}{100}$	LENGTH AND FORM OF PILLAR.							
	Above 22 feet and not exceeding 24 feet.				Above 24 feet and not exceeding 26 feet.			
	TUBULAR. ○	DOUBLE CHANNELS AND FACE PLATES. I		FOUR ANGLES. +	TUBULAR. ○	DOUBLE CHANNELS AND FACE PLATES. I		FOUR ANGLES. +
	Outside diameter.	Channels.	Plates.		Outside diameter.	Channels.	Plates.	
Above and not exceeding	inches.	inches.	inches.	inches.	inches.	inches.	inches.	inches.
11 and 13	9 × ·40	9 × 4 × 4 × ·62		5 × 5 × ·44	9 × ·44	9 × 4 × 4 × ·66		5 × 5 × ·50
13 „ 16	9 × ·44	9 × 4 × 4 × ·66		5 × 5 × ·44	10 × ·40	$8\frac{1}{2} \times 3\frac{1}{2} \times 3\frac{1}{2} \times$ ·44	9 × ·40	5 × 5 × ·50
16 „ 19	10 × ·40	$8\frac{1}{2} \times 3\frac{1}{2} \times 3\frac{1}{2} \times$ ·44	9 × ·40	5 × 5 × ·50	10 × ·44	9 × $3\frac{1}{2} \times 3\frac{1}{2} \times$ ·46	10 × ·40	5 × 5 × ·54
19 „ 22	10 × ·40	$8\frac{1}{2} \times 3\frac{1}{2} \times 3\frac{1}{2} \times$ ·44	10 × ·40	5 × 5 × ·50	10 × ·44	9 × $3\frac{1}{2} \times 3\frac{1}{2} \times$ ·46	10 × ·40	5 × 5 × ·54
22 „ 25	10 × ·44	$8\frac{1}{2} \times 3\frac{1}{2} \times 3\frac{1}{2} \times$ ·46	10 × ·40	5 × 5 × 54	10 × ·50	9 × $3\frac{1}{2} \times 3\frac{1}{2} \times$ ·46	10 × ·40	5 × 5 × ·60
25 „ 29	10 × ·50	9 × $3\frac{1}{2} \times 3\frac{1}{2} \times$ ·46	10 × ·40	5 × 5 × ·60	10 × ·50	$9\frac{1}{2} \times 3\frac{1}{2} \times 3\frac{1}{2} \times$ ·48	10 × ·42	6 × 6 × ·50
29 „ 33	11 × ·50	$9\frac{1}{2} \times 3\frac{1}{2} \times 3\frac{1}{2} \times$ ·48	10 × ·42	6 × 6 × ·50	11 × ·50	10 × $3\frac{1}{2} \times 3\frac{1}{2} \times$ ·48	11 × ·42	6 × 6 × ·54
33 „ 37	12 × ·50	$10\frac{1}{2} \times 3\frac{1}{2} \times 3\frac{1}{2} \times$ ·48	11 × ·42	6 × 6 × ·54	12 × ·50	11 × $3\frac{1}{2} \times 3\frac{1}{2} \times$ ·48	11 × ·46	6 × 6 × ·60
37 „ 42	12 × ·54	11 × $3\frac{1}{2} \times 3\frac{1}{2} \times$ ·48	11 × ·46	6 × 6 × ·60	12 × ·54	11 × $3\frac{1}{2} \times 3\frac{1}{2} \times$ ·48	11 × ·50	6 × 6 × ·60
42 „ 47	13 × ·54	11 × $3\frac{1}{2} \times 3\frac{1}{2} \times$ ·48	12 × ·50	6 × 6 × ·64	13 × ·54	11 × $3\frac{1}{2} \times 3\frac{1}{2} \times$ ·48	12 × ·50	6 × 6 × ·64
47 „ 52	13 × ·60	11 × $3\frac{1}{2} \times 3\frac{1}{2} \times$ ·50	12 × ·56	6 × 6 × ·70	13 × ·60	11 × $3\frac{1}{2} \times 3\frac{1}{2} \times$ ·50	12 × ·56	6 × 6 × ·70
52 „ 58	14 × ·60	11 × $3\frac{1}{2} \times 3\frac{1}{2} \times$ ·50	12 × ·60	7 × 7 × ·60	14 × ·60	11 × $3\frac{1}{2} \times 3\frac{1}{2} \times$ ·50	12 × ·60	7 × 7 × ·60
58 „ 64	15 × ·60	$11\frac{1}{2} \times 3\frac{1}{2} \times 3\frac{1}{2} \times$ ·50	13 × ·60	7 × 7 × ·64	15 × ·60	$11\frac{1}{2} \times 3\frac{1}{2} \times 3\frac{1}{2} \times$ ·50	13 × ·60	7 × 7 × ·64
64 „ 71	16 × ·60	12 × $3\frac{1}{2} \times 3\frac{1}{2} \times$ ·50	13 × ·70	7 × 7 × ·70	16 × ·60	12 × $3\frac{1}{2} \times 3\frac{1}{2} \times$ ·50	13 × ·70	7 × 7 × ·70
71 „ 78	17 × ·60	12 × $3\frac{1}{2} \times 3\frac{1}{2} \times$ ·50	13 × ·74	7 × 7 × ·74	17 × ·60	12 × $3\frac{1}{2} \times 3\frac{1}{2} \times$ ·50	13 × ·74	7 × 7 × ·74
78 „ 86	18 × ·60	12 × 4 × 4 × ·60	13 × ·74	7 × 7 × ·80	18 × ·60	12 × 4 × 4 × ·60	13 × ·74	7 × 7 × ·80
86 „ 94	18 × ·64	12 × 4 × 4 × ·70	13 × ·74	7 × 7 × ·84	18 × ·64	12 × 4 × 4 × ·70	13 × ·74	7 × 7 × ·84
94 „ 102	18 × ·70	12 × 4 × 4 × ·72	14 × ·80	8 × 8 × ·80	18 × ·70	12 × 4 × 4 × ·72	14 × ·80	8 × 8 × ·80
102 „ 110	18 × ·74			8 × 8 × ·84				
110 „ 118								
118 „ 126								
126 „ 134								

1. * S is the fore and aft distance in feet from centre of span to centre of span.

   B is one-third the breadth of vessel in feet at the deck at the head of the pillars, where two rows of pillars are fitted, and one-fourth the breadth where three rows are fitted.

   H is the sum of the heights of the several 'tween decks in feet from top of beam to top of beam above the pillars with an addition of 5 feet for the upper, awning or shelter deck, bridge, poop or forecastle deck.

   In the case of a deck fitted exclusively for the accommodation of passengers, the height of 'tween decks may be taken as being 5 feet.

2. For methods of obtaining the numbers regulating the size of the pillars, *see* Sketches on pages 170 and 171.

3. The rivets in the angles or channels forming pillars are to be spaced not more than 7 diameters apart centre to centre, and when the flanges are 5 inches in width or above, zigzag riveting is to be adopted.

4. The rivets in the seams of built tubular pillars are to be spaced not more than 5 diameters apart.

5. Pillars of other form will be admitted provided they are of equivalent strength to those given in the Table.

WIDELY SPACED STEEL PILLARS. TABLE 15.

(Concluded.)

NUMBERS.* $\frac{S \times B \times H}{100}$	LENGTH AND FORM OF PILLAR.							
	Above 26 feet and not exceeding 28 feet.				Above 28 feet and not exceeding 30 feet.			
	TUBULAR. ○	DOUBLE CHANNELS AND FACE PLATES. I		FOUR ANGLES. +	TUBULAR. ○	DOUBLE CHANNELS AND FACE PLATES. I		FOUR ANGLES. +
	Outside diameter.	Channels.	Plates.		Outside diameter.	Channels.	Plates.	
Above 11 and not exceeding 13	inches. 10 × ·44	inches. 9 × 3½ × 3½ × ·46	inches. 10 × ·40	inches. 5 × 5 × ·54	inches. 10 × ·50	inches. 9½ × 3½ × 3½ × ·48	inches. 10 × ·42	inches. 6 × 6 × ·50
13 „ 16	10 × ·44	9 × 3½ × 3½ × ·46	10 × ·40	5 × 5 × ·54	10 × ·50	9½ × 3½ × 3½ × ·48	11 × ·40	6 × 6 × ·50
16 „ 19	10 × ·50	9 × 3½ × 3½ × ·46	10 × ·40	5 × 5 × ·60	11 × ·44	10 × 3½ × 3½ × ·48	11 × ·42	6 × 6 × ·54
19 „ 22	10 × ·50	9½ × 3½ × 3½ × ·48	11 × ·40	6 × 6 × ·50	11 × ·44	10½ × 3½ × 3½ × ·48	11 × ·42	6 × 6 × ·54
22 „ 25	11 × ·44	10 × 3½ × 3½ × ·48	11 × ·42	6 × 6 × ·54	11 × ·50	11 × 3½ × 3½ × ·48	11 × ·46	6 × 6 × ·60
25 „ 29	11 × ·50	10½ × 3½ × 3½ × ·48	11 × ·46	6 × 6 × ·54	11 × ·50	11 × 3½ × 3½ × ·48	11 × ·46	6 × 6 × ·60
29 „ 33	12 × ·50	11 × 3½ × 3½ × ·48	11 × ·46	6 × 6 × ·60	12 × ·50	11 × 3½ × 3½ × ·48	12 × ·50	6 × 6 × ·64
33 „ 37	12 × ·50	11 × 3½ × 3½ × ·48	11 × ·46	6 × 6 × ·60	12 × ·54	11 × 3½ × 3½ × ·48	12 × ·50	6 × 6 × ·64
37 „ 42	12 × ·54	11 × 3½ × 3½ × ·48	12 × ·50	6 × 6 × ·64	13 × ·54	11 × 3½ × 3½ × ·48	12 × ·56	6 × 6 × ·70
42 „ 47	13 × ·54	11 × 3½ × 3½ × ·48	12 × ·56	6 × 6 × ·70	13 × ·60	11 × 3½ × 3½ × ·50	12 × ·60	7 × 7 × ·60
47 „ 52	13 × ·60	11 × 3½ × 3½ × ·50	12 × ·60	7 × 7 × ·60	14 × ·60	11½ × 3½ × 3½ × ·50	13 × ·60	7 × 7 × ·64
52 „ 58	14 × ·60	11½ × 3½ × 3½ × ·50	12 × ·70	7 × 7 × ·64	15 × ·60	12 × 3½ × 3½ × ·50	13 × ·70	7 × 7 × ·70
58 „ 64	15 × ·60	12 × 3½ × 3½ × ·50	13 × ·70	7 × 7 × ·70	16 × ·60	12 × 3½ × 3½ × ·50	13 × ·74	7 × 7 × ·74
64 „ 71	16 × ·60	12 × 3½ × 3½ × ·50	13 × ·74	7 × 7 × ·74	17 × ·60	12 × 4 × 4 × ·60	13 × ·74	7 × 7 × ·80
71 „ 78	17 × ·60	12 × 4 × 4 × ·60	13 × ·74	7 × 7 × ·80	18 × ·60	12 × 4 × 4 × ·70	13 × ·74	8 × 8 × ·74
78 „ 86	18 × ·60							
86 „ 94								
94 „ 102								
102 „ 110								
110 „ 118								
118 „ 126								
126 „ 134								

6. Arrangements are to be made at the various decks in order to secure an efficient distribution of the support afforded by the pillars. Arrangements are also to be made at the heels of the pillars to secure an effective distribution of the load carried over the adjacent structure. As far as possible the pillars are to be stepped on the tank top at the intersection of a floor and of an intercostal; where this cannot be done partial floors and intercostals are to be fitted. No manholes are to be cut in the floors and intercostals in way of the heels of the pillars.

7. For some methods of attaching the pillars at heads and heels, *see* Sketches on pages 168 and 169.

8. When widely spaced pillars are fitted in accordance with the requirements of the above Table, they are to be of steel having a tensile strength of from 28 to 32 tons per square inch (as per Section 3). If steel of from 22 to 27 tons per square inch tensile strength be used for widely spaced hollow round pillars, the plates from which the pillars are to be made must be increased in thickness as follows:—

Thickness required by above Table for steel of from 28 to 32 tons per sq. inch tensile strength.	in. ·40	in. ·44	in. ·50	in. ·54	in. ·60	in. ·64	in. ·70	in. ·74
Equivalent thickness when steel of from 22 to 27 tons per sq. inch tensile strength is used for hollow pillars.	·48	·52	·60	·64	·72	·76	·82	·88

GIRDERS AT HEADS OF WIDELY SPACED PILLARS.

TABLE **16.**

(See Continuation.)

NUMBERS.* $\frac{S^2 \times B \times H}{100}$	Thickness of Intercostal Plate and Angle.	DEPTH OF BEAMS.			
		5 inches.		6 inches.	
		SIZE OF GIRDERS.			
		Double Channels.	Double Angles.	Double Channels.	Double Angles.
Above 150 and not exceeding 180	·34	inches.	inches. 6 ×4 ×·44	inches.	inches. 6 ×4 ×·40
180 „ 210	·34		6 ×4 ×·50		6 ×4 ×·44
210 „ 250	·34	7 ×3 ×3 ×·38	6 ×4 ×·54		6 ×4 ×·50
250 „ 290	·40	7 ×3½×3½×·40	6 ×4 ×·64	7 ×3 ×3 ×·38	6 ×4 ×·54
290 „ 330	·40	7½×3½×3½×·42	6½×4½×·60	7 ×3½×3½×·40	6 ×4 ×·64
330 „ 380	·40	8 ×3½×3½×·46	6½×4½×·64	7½×3½×3½×·42	6½×4½×·60
380 „ 430	·40	9 ×3½×3½×·46	6 ×6 ×·64	8 ×3½×3½×·46	6½×4½×·64
430 „ 480	·44	9 ×3½×3½×·60	6 ×6 ×·74	9 ×3½×3½×·46	6 ×6 ×·64
480 „ 540	·44	10 ×3½×3½×·60	7 ×7 ×·70	9 ×3½×3½×·60	6 ×6 ×·74
540 „ 600	·44	11 ×3½×3½×·60	7 ×7 ×·80	10 ×3½×3½×·60	7 ×7 ×·70
600 „ 670	·44			11 ×3½×3½×·60	7 ×7 ×·80
670 „ 740	·44			12 ×3½×3½×·60	
740 „ 820	·50				
820 „ 900	·50				
900 „ 990	·50				
990 „ 1090	·50				
1090 „ 1200	·50				
1200 „ 1320	·50				
1320 „ 1450	·50				
1450 „ 1590	·54				
1590 „ 1740	·54				
1740 „ 1900	·54				
1900 „ 2070	·54				

1.*S is the fore and aft spacing of the pillars in feet from centre to centre.

B is one-third the breadth of vessel in feet at the deck when two rows of pillars are fitted, and one-fourth the breadth when three rows are fitted.

H is the height of the 'tween decks next above the girder, measured in feet from top of beam to top of beam, where the pillars in the 'tween decks are spaced the same as those below. In the case of decks fitted exclusively for the accommodation of passengers, and for upper, awning or shelter, bridge, poop or forecastle deck, H is to be taken as 5 feet.

Where the pillars above a deck are not placed over those below, H is to be the sum of the heights of the several 'tween decks in feet above the girder, with the addition of 5 feet for upper, awning or shelter deck, bridge, poop or forecastle deck.

2. For methods of obtaining the numbers regulating the scantlings for girders, *see* Sketches on pages 172 and 173.

3. The girders are to consist of double channels or double angles, intercostal plate and rider plate, of the scantlings given in the Table. (*See* Sketches on pages 168 and 169.)

4. The intercostal plates and channels or angles are to be fitted in long lengths and efficiently strapped or lapped at the butts to the Surveyor's satisfaction.

5. The channels are to be attached by two rivets to the lower flanges of the beams, or, in the case of angle or bulb angle beams to short angle lugs fitted to the beams, and where double angles are fitted in lieu of channels the intercostal plates are to be attached to the beams by angle lugs extending to the bottom of the girder and beams alternately where beams are fitted at every frame and to the bottom of the girder at every beam where beams are fitted at alternate frames. (*See* Sketch on page 169.)

6. The girders are to be efficiently bracketed to the bulkheads with plates three times the depth of the channels forming girders, measured from the upper edges of the channels and of the same thickness as the channels. The angle attaching the intercostal plate to the deck plating and intercostal plates to beams is to be of the same thickness as the plate, this angle is to be 3 ins. × 3 ins. where the rivets in the intercostal plates are required to be ¾ in. in diameter, and 3½ ins. × 3½ ins. where they are ⅞ in. in diameter. The channels and double angles to be zigzag riveted and the rivets spaced not more than 7 diameters apart and those in the flanges of the intercostal angle not more than 5 diameters apart, centre to centre.

7. Girders of other form will be admitted provided they are of equivalent strength to those given in the Table.

GIRDERS AT HEADS OF WIDELY SPACED PILLARS. TABLE 16.

(See Continuation.)

NUMBERS.* $\frac{S^2 \times B \times H}{100}$	Thickness of Intercostal Plate and Angle.	DEPTH OF BEAMS.					
		7 inches.			8 inches.		
		SIZE OF GIRDERS.					
		Double Channels.	Rider Plate.	Double Angles.	Double Channels.	Rider Plate.	Double Angles.
Above 150 and not exceeding 180	·34	inches.	inches.	inches.	inches.	inches.	inches.
180 „ 210	·34			6 ×4 ×·40			
210 „ 250	·34			6 ×4 ×·44			6 ×4 ×·40
250 „ 290	·40			6 ×4 ×·50			6 ×4 ×·44
290 „ 330	·40	7 ×3 ×3 ×·38		6 ×4 ×·54			6 ×4 ×·50
330 „ 380	·40	7 ×3½×3½×·40		6 ×4 ×·64	7 ×3 ×3 ×·38		6 ×4 ×·54
380 „ 430	·40	7½×3½×3½×·42		6½×4½×·60	7 ×3½×3½×·40		6 ×4 ×·64
430 „ 480	·44	8 ×3½×3½×·46		6½×4½×·64	7½×3½×3½×·42		6½×4½×·60
480 „ 540	·44	9 ×3½×3½×·46		6 ×6 ×·64	8 ×3½×3½×·46		6½×4½×·64
540 „ 600	·44	9 ×3½×3½×·60		6 ×6 ×·74	9 ×3½×3½×·46		6 ×6 ×·64
600 „ 670	·44	10 ×3½×3½×·60		7 ×7 ×·70	9 ×3½×3½×·60		6 ×6 ×·74
670 „ 740	·44	11 ×3½×3½×·60		7 ×7 ×·80	10 ×3½×3½×·60		7 ×7 ×·70
740 „ 820	·50	12 ×3½×3½×·60			11 ×3½×3½×·60		7 ×7 ×·80
820 „ 900	·50	12 ×4 ×4 ×·64			12 ×3½×3½×·60		
900 „ 990	·50	12 ×3½×3½×·60	8×·60		12 ×4 ×4 ×·64		
990 „ 1090	·50	12 ×3½×3½×·70	8×·70		12 ×3½×3½×·60	8×·60	
1090 „ 1200	·50				12 ×3½×3½×·70	8×·70	
1200 „ 1320	·50				12 ×4 ×4 ×·70	9×·70	
1320 „ 1450	·50				12 ×4 ×4 ×·72	10×·74	
1450 „ 1590	·54						
1590 „ 1740	·54						
1740 „ 1900	·54						
1900 „ 2070	·54						

1.* S is the fore and aft spacing of the pillars in feet from centre to centre.

B is one-third the breadth of vessel in feet at the deck when two rows of pillars are fitted, and one-fourth the breadth when three rows are fitted.

H is the height of the 'tween decks next above the girder, measured in feet from top of beam to top of beam, where the pillars in the 'tween decks are spaced the same as those below. In the case of decks fitted exclusively for the accommodation of passengers, and for upper, awning or shelter, bridge, poop or forecastle deck, H is to be taken as 5 feet.

Where the pillars above a deck are not placed over those below, H is to be the sum of the heights of the several 'tween decks in feet above the girder, with the addition of 5 feet for upper, awning or shelter deck, bridge, poop or forecastle deck.

2. For methods of obtaining the numbers regulating the scantlings for girders, *see* Sketches on pages 172 and 173.

3. The girders are to consist of double channels or double angles, intercostal plate and rider plate, of the scantlings given in the Table. (*See* Sketches on pages 168 and 169.)

4. The intercostal plates and channels or angles are to be fitted in long lengths and efficiently strapped or lapped at the butts to the Surveyor's satisfaction.

5. The channels are to be attached by two rivets to the lower flanges of the beams, or in the case of angle or bulb angle beams to short angle lugs fitted to the beams, and where double angles are fitted in lieu of channels the intercostal plates are to be attached to the beams by angle lugs extending to the bottom of the girder and beams alternately where beams are fitted at every frame and to the bottom of the girder at every beam where beams are fitted at alternate frames. (*See* Sketch on page 169.)

6. The girders are to be efficiently bracketed to the bulkheads with plates three times the depth of the channels forming girders, measured from the upper edges of the channels and of the same thickness as the channels. The angle attaching the intercostal plate to the deck plating and intercostal plates to beams is to be of the same thickness as the plate, this angle is to be 3 ins. × 3 ins. where the rivets in the intercostal plates are required to be ¾ in in diameter, and 3½ ins. × 3½ ins. where they are ⅞ in. in diameter. The channels and double angles to be zigzag riveted and the rivets spaced not more than 7 diameters apart, and those in the flanges of the intercostal angle not more than 5 diameters apart, centre to centre.

7. Girders of other form will be admitted provided they are of equivalent strength to those given in the Table.

GIRDERS AT HEADS OF WIDELY SPACED PILLARS. TABLE 16.

(See Continuation.)

NUMBERS.* $\frac{S^2 \times B \times H}{100}$	Thickness of Intercostal Plate and Angle.	DEPTH OF BEAMS.					
		9 inches.			10 inches.		
		SIZE OF GIRDERS.					
		Double Channels.	Rider Plate.	Double Angles.	Double Channels.	Rider Plate.	Double Angles.
		inches.	inches.	inches.	inches.	inches.	inches.
Above 150 and not exceeding 180	·34						
180 „ 210	·34						
210 „ 250	·34						
250 „ 290	·40			6 ×4 ×·40			
290 „ 330	·40			6 ×4 ×·44			6 ×4 ×·40
330 „ 380	·40			6 ×4 ×·50			6 ×4 ×·44
380 „ 430	·40	7 ×3 ×3 ×·38		6 ×4 ×·54			6 ×4 ×·50
430 „ 480	·44	7 ×3½×3½×·40		6 ×4 ×·64	7 ×3 ×3 ×·38		6 ×4 ×·54
480 „ 540	·44	7½×3½×3½×·42		6½×4½×·60	7 ×3½×3½×·40		6 ×4 ×·64
540 „ 600	·44	8 ×3½×3½×·46		6½×4½×·64	7½×3½×3½×·46		6½×4½×·60
600 „ 670	·44	9 ×3½×3½×·46		6 ×6 ×·64	8 ×3½×3½×·46		6½×4½×·64
670 „ 740	·44	9 ×3½×3½×·60		6 ×6 ×·74	9 ×3½×3½×·46		6 ×6 ×·64
740 „ 820	·50	10 ×3½×3½×·60		7 ×7 ×·70	9 ×3½×3½×·60		6 ×6 ×·74
820 „ 900	·50	11 ×3½×3½×·60		7 ×7 ×·80	10 ×3½×3½×·60		7 ×7 ×·70
900 „ 990	·50	12 ×3½×3½×·60			11 ×3½×3½×·60		7 ×7 ×·80
990 „ 1090	·50	12 ×4 ×4 ×·64			12 ×3½×3½×·60		
1090 „ 1200	·50	12 ×3½×3½×·60	8×·60		12 ×4 ×4 ×·64		
1200 „ 1320	·50	12 ×3½×3½×·70	8×·70		12 ×3½×3½×·60	8×·60	
1320 „ 1450	·50	12 ×4 ×4 ×·70	9×·70		12 ×3½×3½×·70	8×·70	
1450 „ 1590	·54	12 ×4 ×4 ×·72	10×·74		12 ×4 ×4 ×·70	9×·70	
1590 „ 1740	·54				12 ×4 ×4 ×·72	10×·74	
1740 „ 1900	·54						
1900 „ 2070	·54						

1.* S is the fore and aft spacing of the pillars in feet from centre to centre.
B is one-third the breadth of vessel in feet at the deck when two rows of pillars are fitted, and one-fourth the breadth when three rows are fitted.
H is the height of the 'tween decks next above the girder, measured in feet from top of beam to top of beam, where the pillars in the 'tween decks are spaced the same as those below. In the case of decks fitted exclusively for the accommodation of passengers, and for upper, awning or shelter, bridge, poop or forecastle deck, H is to be taken as 5 feet.

Where the pillars above a deck are not placed over those below, H is to be the sum of the heights of the several 'tween decks in feet above the girder, with the addition of 5 feet for upper, awning or shelter deck, bridge, poop or forecastle deck.

2. For methods of obtaining the numbers regulating the scantlings for girders, *see* Sketches on pages 172 and 173.

3. The girders are to consist of double channels or double angles, intercostal plate and rider plate, of the scantlings given in the Table. (*See* Sketches on pages 168 and 169.)

4. The intercostal plates and channels or angles are to be fitted in long lengths and efficiently strapped or lapped at the butts to the Surveyor's satisfaction.

5. The channels are to be attached by two rivets to the lower flanges of the beams, or, in the case of angle or bulb angle beams to short angle lugs fitted to the beams, and where double angles are fitted in lieu of channels the intercostal plates are to be attached to the beams by angle lugs extending to the bottom of the girder and beams alternately where beams are fitted at every frame and to the bottom of the girder at every beam where beams are fitted at alternate frames. (*See* Sketch on page 169.)

6. The girders are to be efficiently bracketed to the bulkheads with plates three times the depth of the channels forming girders, measured from the upper edges of the channels and of the same thickness as the channels. The angle attaching the intercostal plate to the deck plating and intercostal plates to beams is to be of the same thickness as the plate, this angle is to be 3 ins. × 3 ins. where the rivets in the intercostal plates are required to be ¾ in. in diameter, and 3½ ins. × 3½ ins. where they are ⅞ in. in diameter. The channels and double angles to be zigzag riveted and the rivets spaced not more than 7 diameters apart, and those in the flanges of the intercostal angle not more than 5 diameters apart, centre to centre.

7. Girders of other form will be admitted provided they are of equivalent strength to those given in the Table.

GIRDERS AT HEADS OF WIDELY SPACED PILLARS. TABLE 16. *(Concluded.)*

NUMBERS * $\frac{S^2 \times B \times H}{100}$	Thickness of Intercostal Plate and Angle.	DEPTH OF BEAMS.					
		11 inches.			12 inches.		
		SIZE OF GIRDERS.					
		Double Channels.	Rider Plate.	Double Angles.	Double Channels.	Rider Plate.	Double Angles.
Above 150 and not exceeding 180	·34	inches.	inches.	inches.	inches.	inches.	inches.
180 „ 210	·34						
210 „ 250	·34						
250 „ 290	·40						
290 „ 330	·40						
330 „ 380	·40			6 ×4 ×·40			
380 „ 430	·40			6 ×4 ×·44			6 ×4 ×·40
430 „ 480	·44			6 ×4 ×·50			6 ×4 ×·44
480 „ 540	·44	7 ×3 ×3 ×·38		6 ×4 ×·54			6 ×4 ×·50
540 „ 600	·44	7 ×3½ ×3½ ×·40		6 ×4 ×·64	7 ×3 ×3 ×·38		6 ×4 ×·54
600 „ 670	·44	7½ ×3½ ×3½ ×·46		6½ ×4½ ×·60	7 ×3½ ×3½ ×·40		6 ×4 ×·64
670 „ 740	·44	8 ×3½ ×3½ ×·46		6½ ×4½ ×·64	7½ ×3½ ×3½ ×·42		6½ ×4½ ×·60
740 „ 820	·50	9 ×3½ ×3½ ×·46		6 ×6 ×·64	8 ×3½ ×3½ ×·46		6½ ×4½ ×·64
820 „ 900	·50	9 ×3½ ×3½ ×·60		6 ×6 ×·74	9 ×3½ ×3½ ×·46		6 ×6 ×·64
900 „ 990	·50	10 ×3½ ×3½ ×·60		7 ×7 ×·70	9 ×3½ ×3½ ×·60		6 ×6 ×·74
990 „ 1090	·50	11 ×3½ ×3½ ×·60		7 ×7 ×·80	10 ×3½ ×3½ ×·60		7 ×7 ×·70
1090 „ 1200	·50	12 ×3½ ×3½ ×·60			11 ×3½ ×3½ ×·60		7 ×7 ×·80
1200 „ 1320	·50	12 ×4 ×4 ×·64			12 ×3½ ×3½ ×·60		
1320 „ 1450	·50	12 ×3½ ×3½ ×·60	8 ×·60		12 ×4 ×4 ×·64		
1450 „ 1590	·54	12 ×3½ ×3½ ×·70	8 ×·70		12 ×3½ ×3½ ×·60	8 ×·60	
1590 „ 1740	·54	12 ×4 ×4 ×·70	9 ×·70		12 ×3½ ×3½ ×·70	8 ×·70	
1740 „ 1900	·54	12 ×4 ×4 ×·72	11 ×·74		12 ×4 ×4 ×·72	10 ×·70	
1900 „ 2070	·54				12 ×4 ×4 ×·72	11 ×·82	

1.* S is the fore and aft spacing of the pillars in feet from centre to centre.
B is one-third the breadth of vessel in feet at the deck when two rows of pillars are fitted, and one-fourth the breadth when three rows are fitted.
H is the height of the 'tween decks next above the girder, measured in feet from top of beam to top of beam, where the pillars in the 'tween decks are spaced the same as those below. In the case of decks fitted exclusively for the accommodation of passengers, and for upper, awning or shelter, bridge, poop or forecastle deck, H is to be taken as 5 feet.

Where the pillars above a deck are not placed over those below, H is to be the sum of the heights of the several 'tween decks in feet above the girder, with the addition of 5 feet for upper, awning or shelter deck, bridge, poop or forecastle deck.

2. For methods of obtaining the numbers regulating the scantlings for girders, *see* Sketches on pages 172 and 173.

3. The girders are to consist of double channels or double angles, intercostal plate and rider plate, of the scantlings given in the Table. (*See* Sketches on pages 168 and 169.)

4. The intercostal plates and channels or angles are to be fitted in long lengths and efficiently strapped or lapped at the butts to the Surveyor's satisfaction.

5. The channels are to be attached by two rivets to the lower flanges of the beams, or, in the case of angle or bulb angle beams to short angle lugs fitted to the beams, and where double angles are fitted in lieu of channels the intercostal plates are to be attached to the beams by angle lugs extending to the bottom of the girder and beams alternately where beams are fitted at every frame and to the bottom of the girder at every beam where beams are fitted at alternate frames. (*See* Sketch on page 169.)

6. The girders are to be efficiently bracketed to the bulkheads with plates three times the depth of the channels forming girders, measured from the upper edges of the channels and of the same thickness as the channels. The angle attaching the intercostal plate to the deck plating and intercostal plates to beams is to be of the same thickness as the plate, this angle is to be 3 ins. × 3 ins. where the rivets in the intercostal plates are required to be ¾ in. in diameter, and 3½ ins. × 3½ ins. where they are ⅞ in. in diameter. The channels and double angles to be zigzag riveted and the rivets spaced not more than 7 diameters apart, and those in the flanges of the intercostal angle not more than 5 diameters apart, centre to centre.

7. Girders of other form will be admitted provided they are of equivalent strength to those given in the Table.

LLOYD'S REGISTER OF SHIPPING, LONDON.—*11th May, 1911.*

OUTSIDE PLATING.

TABLE 17.

(See Continuation.)

LONGITUDINAL NUMBER. L×(B+D).		BREADTH OF FLAT KEEL PLATE AND GARBOARD STRAKES.	FLAT KEEL PLATE.		THICKNESS OF GARBOARD STRAKE WITH BAR KEEL.		THICKNESS OF OUTSIDE PLATING.				
			Thickness for $\frac{3}{5}$ length Amidships without Doubling.	Thickness throughout if Doubled for $\frac{3}{5}$ length Amidships, also thickness at Ends if Keel Plate is fitted without Doubling.	For $\frac{1}{2}$ length Amidships.	At Ends.	From Flat Keel Plate or Garboard Strake to Upper Turn of Bilge.		From Upper Turn of Bilge to Strake below Sheerstrake.		Propeller Boss Plates.
							For $\frac{1}{2}$ length Amidships.	At Ends.	For $\frac{1}{2}$ length Amidships.	At Ends.	
Above	not exceeding	inches.	inches.	inches.	inches.	inches.	inches.	inches.	inches.	inches.	inches.
1250 and	1500	30	·36	·30	·28	·24	·24	·24	·24	·24	·24
1500 „	1750	„	„	„	„	„	„	„	„	„	„
1750 „	2000	31	·38	·32	·30	·26	„	„	„	„	„
2000 „	2250	„	·40	·34	„	„	·26	„	„	„	·26
2250 „	2500	32	„	„	·32	·28	„	„	·26	„	„
2500 „	2750	„	·42	·36	„	„	„	„	„	„	„
2750 „	3000	33	·44	„	·34	·30	·28	·26	„	„	·28
3000 „	3350	„	„	„	„	„	„	„	·28	·26	„
3350 „	3700	34	·46	·38	·36	·32	·30	„	„	„	·30
3700 „	4050	„	·48	·40	„	„	„	„	·30	„	„
4050 „	4400	35	„	„	·38	·34	·32	·28	„	„	·32
4400 „	4800	„	·50	·42	„	„	„	„	·32	·28	„
4800 „	5200	36	·52	„	·40	·36	·34	·30	„	„	·34
5200 „	5650	„	„	„	„	„	„	„	·34	·30	„
5650 „	6100	37	·54	·44	·42	·38	·36	·32	„	„	·36
6100 „	6600	„	·56	·46	„	„	„	„	·36	·32	„
6600 „	7100	38	„	„	·44	·40	·38	·34	„	„	·38
7100 „	7650	„	·58	„	„	„	„	„	·38	·34	„
7650 „	8200	39	·60	·48	·46	·42	·40	·36	„	„	·40
8200 „	8900	„	„	„	„	„	„	„	·40	·36	„
8900 „	9600	40	·62	·50	·48	„	·42	„	„	„	·42
9600 „	10300	„	·64	„	„	„	·44	·38	·42	„	·44
10300 „	11000	41	·66	·52	·50	·44	·46	„	·44	·38	·46
11000 „	11800	„	·68	„	„	„	„	„	·46	„	·48
11800 „	12600	42	·70	·54	·52	·46	·48	·40	„	„	·50
12600 „	13600	„	·72	„	„	„	„	„	·48	·40	·52
13600 „	14600	„	·74	·56	·54	·48	·50	„	„	„	·54
14600 „	15800	43	·76	„	„	„	„	„	·50	„	·56
15800 „	17000	„	·78	·58	·56	„	·52	·42	„	„	·58
17000 „	18200	„	·80	„	„	„	„	„	·52	„	·60
18200 „	19500	44	·82	„	·58	·50	·54	„	„	„	·62
19500 „	20800	„	·84	·60	„	„	„	„	·54	·42	·64
20800 „	22200	„	·86	·62	·60	·52	·56	·44	„	„	·66
22200 „	23600	45	·88	„	„	„	„	„	·56	„	„
23600 „	25000	„	·90	·64	·62	·54	·58	„	„	„	·68
25000 „	26400	„	„	„	„	„	„	„	·58	·44	„
26400 „	27800	46	·92	·66	·64	„	·60	·46	„	„	·70
27800 „	29200	„	·94	„	„	„	„	„	·60	„	„

OUTSIDE PLATING.

TABLE 17.

(See Continuation.)

LONGITUDINAL. NUMBER. L×(B+D).	BREADTH OF FLAT KEEL PLATE AND GARBOARD STRAKES.	FLAT KEEL PLATE.		THICKNESS OF GARBOARD STRAKE WITH BAR KEEL.		THICKNESS OF OUTSIDE PLATING.				
		Thickness for $\frac{3}{5}$ length Amidships without Doubling.	Thickness throughout if Doubled for $\frac{3}{5}$ length Amidships, also thickness at Ends if Keel Plate is fitted without Doubling.	For $\frac{1}{2}$ length Amidships.	At Ends.	From Flat Keel Plate or Garboard Strake to Upper Turn of Bilge		From Upper Turn of Bilge to Strake below Sheerstrake.		Propeller Boss Plates.
						For $\frac{1}{2}$ length Amidships.	At Ends.	For $\frac{1}{2}$ length Amidships.	At Ends.	
Above 29200 and not exceeding 30600	inches. 46	inches. ·96	inches. ·68	inches. ·66	inches. ·56	inches. ·62	inches. ·46	inches. ·60	inches. ·44	inches. ·72
30600 „ 32000	47	·98	·70	„	„	„	„	·62	„	„
32000 „ 33400	„	1·00	„	·68	·58	·64	·48	„	„	·74
33400 „ 34800	„	1·02	·72	„	„	„	„	·64	·46	„
34800 „ 36200	48	1·04	„	·70	·60	·66	„	„	„	·76
36200 „ 37600	„	1·06	·74	„	„	„	„	„	„	„
37600 „ 39000	„	1·08	·76	·72	·62	·68	·50	·66	„	·78
39000 „ 40400	49	1·10	„	„	„	„	„	„	„	„
40400 „ 41800	„	1·12	·78			·70	„	·68	·48	·80
41800 „ 43200	„	1·14	·80			„	„	„	„	„
43200 „ 44600	50	1·16	„			·72	·52	„	„	·82
44600 „ 46000	„	1·18	·82			„	„	·70	„	„
46000 „ 47400	„	1·20	„			·74	„	„	„	·84
47400 „ 48800	51		·84			„	„	·72	·50	„
48800 „ 50200	„		„			·76	·54	„	„	·86
50200 „ 51600	„		·86			„	„	„	„	„
51600 „ 53000	52		„			·78	„	·74	„	·88
53000 „ 54400	„		·88			„	„	„	„	„
54400 „ 55800	„		„			·80	·56	·76	·52	·90
55800 „ 57200	53		·90			„	„	„	„	„
57200 „ 58600	„		„			·82	„	„	„	·92
58600 „ 60000	„		·92			„	„	·78	„	„
60000 „ 61400	54		„			·84	·58	„	„	·94
61400 „ 62800	„		·94			„	„	·80	·54	„
62800 „ 64200	„		„			·86	„	„	„	·96
64200 „ 65600	55		·96			„	„	„	„	„
65600 „ 67000	„		„			·88	·60	·82	·56	·98
67000 „ 68400	„		·98			„	„	„	„	„
68400 „ 69800	56		„			·90	„	·84	„	1·00
69800 „ 71200	„		1·00			„	„	„	„	„
71200 „ 72600	„		„			·92	·62	„	„	1·02
72600 „ 74000	57		1·02			„	„	·86	·58	„
74000 „ 75400	„		„			·94	„	„	„	1·04
75400 „ 76800	„		1·04			„	„	·88	„	„
76800 „ 78200	58		„			·96	·64	„	„	1·06
78200 „ 79600	„		1·06			„	„	„	„	„
79600 „ 81000	„		„			·98	„	·90	·60	1·08

LOWER DECKS.

TABLE 17.

(See Continuation.)

LONGITUDINAL NUMBER. L×(B+D).	2ND DECK (UPPER DECK IN AWNING OR SHELTER DECK VESSELS).		3RD DECK (2ND DECK IN AWNING OR SHELTER DECK VESSELS).		DECKS BELOW 3RD DECK (2ND DECK IN AWNING OR SHELTER DECK VESSELS).		BEAM STRINGERS AT ENDS OF 2ND DECK (UPPER DECK IN AWNING OR SHELTER DECK VESSELS) AND ALL DECKS BELOW, ALSO THICKNESS OF TIE PLATES AT ENDS.	THICKNESS OF 2ND AND 3RDDECKS (UPPER AND 2ND DECKS IN AWNING OR SHELTER DECK VESSELS) AT ENDS.	DECK STRINGER ANGLES AT ALL LOWER DECKS, AND AT UPPER DECKS IN WAY OF ERECTIONS.	
	Stringer for $\frac{1}{2}$ length Amidships.	Tie Plates for $\frac{1}{2}$ length Amidships.	Stringer for $\frac{1}{2}$ length Amidships.	Tie Plates for $\frac{1}{2}$ length Amidships.	Stringer for $\frac{1}{2}$ length Amidships.	Tie Plates for $\frac{1}{2}$ length Amidships.			For $\frac{1}{2}$ length Amidships.	At Ends.
Above 1250 and not exceeding 1500	inches.	inches.	inches.	inches.	inches.	inches.	inches.	inches.	inches.	inches.
1250 and not exceeding 1500									$2\frac{1}{2}\times2\frac{1}{2}\times\cdot22$	·22
1500 „ 1750									„ „ „	„
1750 „ 2000									„ „ ·24	·24
2000 „ 2250									„ „ „	„
2250 „ 2500									„ „ „	„
2500 „ 2750									„ „ ·26	·26
2750 „ 3000									„ „ „	„
3000 „ 3350									„ „ ·28	·28
3350 „ 3700									„ „ „	„
3700 „ 4050									„ „ „	„
4050 „ 4400									3 ×3 × „	„
4400 „ 4800									„ „ „	„
4800 „ 5200									„ „ ·30	·30
5200 „ 5650									„ „ „	„
5650 „ 6100									„ „ ·32	·32
6100 „ 6600									„ „ „	„
6600 „ 7100									„ „ „	„
7100 „ 7650									„ „ ·34	„
7650 „ 8200									„ „ „	„
8200 „ 8900									„ „ „	„
8900 „ 9600	40×·34	9 ×·34					18 ×·34		„ „ „	·34
9600 „ 10300	„ „	„ „					19 „		„ „ „	„
10300 „ 11000	41×·36	10 ×·36					20 „		„ „ ·36	„
11000 „ 11800	„ „	„ „					21 „		„ „ „	„
11800 „ 12600	42 „	„ „					22 ×·36		„ „ „	·36
12600 „ 13600	„ ·38	11 ×·38					23 „		$3\frac{1}{2}\times3\frac{1}{2}\times\cdot38$	„
13600 „ 14600	„ „	„ „					24 „		„ „ „	„
14600 „ 15800	43 „	„ „					25 „		„ „ „	„
15800 „ 17000	„ ·40	12 ×·40	43 ×·38	12 ×·38			26 ×·38		„ „ ·40	·38
17000 „ 18200	„ „	„ „	„ „	„ „			27 „		„ „ „	„
18200 „ 19500	44 „	„ „	44 „	„ „			28 „		„ „ „	„
19500 „ 20800	„ ·42	13 ×·42	„ „	13 „			29 „		„ „ ·42	„
20800 „ 22200	„ „	„ „	„ ·40	„ ·40			30 ×·40		„ „ „	·40
22200 „ 23600	45 „	„ „	45 „	„ „			31 „		„ „ „	„
23600 „ 25000	„ ·44	14 ×·44	„ „	14 „			32 „		„ „ ·44	„
25000 „ 26400	„ „	„ „	„ „	„ „			„ „		„ „ „	„
26400 „ 27800	46 „	„ „	46 ×·42	„ ·42			33 ×·42		„ „ „	·42
27800 „ 29200	„ ·46	15 ×·46	„ „	15 „			„ „		„ „ ·46	„

LOWER DECKS.

TABLE 17.

(See Continuation)

LONGITUDINAL NUMBER. L×(B+D).	2ND DECK (UPPER DECK IN AWNING OR SHELTER DECK VESSELS).		3RD DECK (2ND DECK IN AWNING OR SHELTER DECK VESSELS).		DECKS BELOW 3RD DECK (2ND DECK IN AWNING OR SHELTER DECK VESSELS).		BEAM STRINGERS AT ENDS OF 2ND DECK (UPPER DECK IN AWNING OR SHELTER DECK VESSELS) AND ALL DECKS BELOW, ALSO THICKNESS OF TIE PLATES AT ENDS.	THICKNESS OF 2ND AND 3RDDECKS (UPPER AND 2ND DECKS IN AWNING OR SHELTER DECK VESSELS) AT ENDS.	DECK STRINGER ANGLES AT ALL LOWER DECKS, AND AT UPPER DECKS IN WAY OF ERECTIONS.	
	Stringer for $\frac{1}{2}$ length Amidships.	Tie Plates and Deck Plating for $\frac{1}{2}$ length Amidships.	Stringer for $\frac{1}{2}$ length Amidships.	Tie Plates and Deck Plating for $\frac{1}{2}$ length Amidships.	Stringer for $\frac{1}{2}$ length Amidships.	Tie Plates for $\frac{1}{2}$ length Amidships.			For $\frac{1}{2}$ length Amidships.	At Ends.
Above 29200 and not exceeding 30600	inches. 46 × ·46	inches. 15 × ·46	inches. 46 × ·42	inches. 15 × ·42	inches.	inches.	inches. 34 × ·42	inches.	inches. $3\frac{1}{2} \times 3\frac{1}{2} \times$ ·46	inches. ·42
30600 „ 32000	47 „	„ „	47 „	„ „			„ „		„ „ „	„
32000 „ 33400	„ ·48	Dk. ·36 Pltg.	„ ·44	16 × ·44			35 × ·44	·30	„ „ ·48	·44
33400 „ 34800	„ „	„	„ „	„ „			„ „	„	„ „ „	„
34800 „ 36200	48 „	·38	48 „	„ „			36 „	„	„ „ „	„
36200 „ 37600	„ „	„	„ „	17 „			„ „	„	„ „ „	„
37600 „ 39000	„ „	·40	„ „	„ „			37 „	·32	„ „ „	„
39000 „ 40400	49 „	„	49 „	„ „			„ „	„	„ „ „	„
40400 „ 41800	„ ·50	„	„ „	18 „			„ „	„	4 × 4 × ·50	„
41800 „ 43200	„ „	„	„ „	„ „			38 „	„	„ „ „	„
43200 „ 44600	50 „	„	50 „	„ „			„ „	„	„ „ „	„
44600 „ 46000	„ „	·42	„ „	19 „	50 × ·44	19 × ·44	„ „	„	„ „ „	„
46000 „ 47400	„ „	„	„ „	Dk. ·36 Pltg.	„ „	„ „	39 „	„	„ „ „	„
47400 „ 48800	51 „	„	51 „	„	51 „	„ „	„ „	„	„ „ „	„
48800 „ 50200	„ ·52	„	„ ·46	„	„ ·46	20 × ·46	„ ·46	„	„ „ ·52	·46
50200 „ 51600	„ „	„	„ „	„	„ „	„ „	40 „	„	„ „ „	„
51600 „ 53000	52 „	·44	52 „	„	52 „	„ „	„ „	„	„ „ „	„
53000 „ 54400	„ „	„	„ „	„	„ „	21 „	„ „	„	„ „ „	„
54400 „ 55800	„ „	„	„ „	·38	„ „	„ „	41 „	·34	„ „ „	„
55800 „ 57200	53 „	„	53 „	„	53 „	„ „	„ „	„	„ „ „	„
57200 „ 58600	„ ·54	·46	„ „	„	„ „	22 „	„ „	„	„ „ ·54	„
58600 „ 60000	„ „	„	„ „	„	„ „	„ „	42 „	„	„ „ „	„
60000 „ 61400	54 „	„	54 „	„	54 „	„ „	„ „	„	„ „ „	„
61400 „ 62800	„ „	„	„ „	·40	„ „	23 „	„ „	„	„ „ „	„
62800 „ 64200	„ „	·48	„ ·48	„	„ ·48	„ ·48	43 × ·48	„	„ „ „	·48
64200 „ 65600	55 „	„	55 „	„	55 „	„ „	„ „	„	„ „ „	„
65600 „ 67000	„ ·56	„	„ „	„	„ „	24 „	„ „	„	„ „ ·56	„
67000 „ 68400	„ „	·50	„ „	„	„ „	„ „	44 „	„	„ „ „	„
68400 „ 69800	56 „	„	56 × ·50	·42	56 × ·50	„ ·50	„ „	·36	„ „ „	„
69800 „ 71200	„ ·58	„	„ „	„	„ „	25 „	„ „	„	„ „ ·58	„
71200 „ 72600	„ „	·52	„ „	„	„ „	„ „	45 „	„	„ „ „	„
72600 „ 74000	57 „	„	57 „	„	57 „	„ „	„ ·50	„	„ „ „	·50
74000 „ 75400	„ ·60	„	„ ·52	„	„ ·52	26 × ·52	„ „	„	„ „ ·60	„
75400 „ 76800	„ „	·54	„ „	·44	„ „	„ „	„ „	„	„ „ „	„
76800 „ 78200	58 „	„	58 „	„	58 „	„ „	46 „	„	„ „ „	„
78200 „ 79600	„ ·62	„	„ „	„	„ „	27 „	„ „	„	„ „ ·62	„
79600 „ 81000	„ „	·56	„ ·54	„	„ ·54	„ „	„ „	„	„ „ „	„

In a vessel requiring two steel decks the thickness of the stringers and deck plating of the 2nd deck may in way of a "long" bridge be as required for a 3rd deck, but in no case is the deck plating to be less than ·36 of an inch in thickness.

"SHORT" ERECTIONS.

TABLE 17.

(See Continuation.)

LONGITUDINAL NUMBER. L×(B+D).	"SHORT" ERECTIONS.													
	POOPS.				"SHORT" BRIDGES.					FORECASTLES.				
	Side Plating	Stringer Angle.	Stringer Plate.	Tie Plates.	Maximum Length of "Short" Bridge.	Side Plating	Stringer Angle.	Stringer Plate.	Tie Plates and Deck Plating.	Side Plating	Stringer Angle.	Stringer Plate.	Tie Plates.
Above / not exceeding	inches.	inches.	inches.	inches.	feet.	inches.	inches.	inches.	inches.	inches.	inches.	inches.	inches.
1250 and 1500	·22	$2\frac{1}{2}\times2\frac{1}{2}\times\cdot22$	10×·22	5×·22	20	·22	$2\frac{1}{2}\times2\frac{1}{2}\times\cdot22$	14×·22	5×·22	·22	$2\frac{1}{2}\times2\frac{1}{2}\times\cdot22$	10×·22	5×·22
1500 „ 1750	„	„ „ „	„ „	„ „	„	„	„ „ „	15 „	„ „	„	„ „ „	„ „	„ „
1750 „ 2000	„	„ „ „	11 „	„ „	„	„	„ „ „	16 „	„ „	„	„ „ „	11 „	„ „
2000 „ 2250	„	„ „ „	„ „	„ „	25	„	„ „ „	17 „	„ „	„	„ „ „	„ „	„ „
2250 „ 2500	„	„ „ „	„ „	„ „	„	„	„ „ „	18 „	„ „	„	„ „ „	„ „	„ „
2500 „ 2750	„	„ „ „	12 „	„ „	„	„	„ „ „	19 „	6 „	„	„ „ „	12 „	„ „
2750 „ 3000	„	„ „ „	„ „	6 „	30	„	„ „ „	20 „	„ „	„	„ „ „	6 „	„ „
3000 „ 3350	„	„ „ „	„ „	„ „	„	„	„ „ „	21 „	„ „	„	„ „ „	„ „	„ „
3350 „ 3700	·24	„ „ ·24	13×·24	„ ·24	„	·24	„ „ ·24	22×·24	„ ·24	·24	„ „ ·24	13×·24	„ ·24
3700 „ 4050	„	„ „ „	„ „	„ „	35	„	„ „ „	23 „	„ „	„	„ „ „	„ „	„ „
4050 „ 4400	„	„ „ „	„ „	„ „	„	„	„ „ „	24 „	„ „	„	„ „ „	„ „	„ „
4400 „ 4800	„	„ „ „	14 „	„ „	„	„	„ „ „	25 „	„ „	„	„ „ „	14 „	„ „
4800 „ 5200	„	„ „ „	„ „	„ „	40	„	„ „ „	26 „	„ „	„	„ „ „	„ „	„ „
5200 „ 5650	„	3 × 3 „	„ „	„ „	„	„	3 × 3 „	27 „	„ „	„	3 × 3 „	„ „	„ „
5650 „ 6100	„	„ „ „	15 „	„ „	„	„	„ „ „	28 „	„ „	„	„ „ „	15 „	„ „
6100 „ 6600	„	„ „ „	„ „	„ „	45	„	„ „ „	29 „	7 „	„	„ „ „	„ „	„ „
6600 „ 7100	·26	„ „ ·26	16×·26	7×·26	„	·26	„ „ ·26	30×·26	„ ·26	·26	„ „ ·26	16×·26	7×·26
7100 „ 7650	„	„ „ „	„ „	„ „	„	„	„ „ „	31 „	„ „	„	„ „ „	„ „	„ „
7650 „ 8200	„	„ „ „	17 „	„ „	50	„	„ „ „	32 „	„ „	„	„ „ „	17 „	„ „
8200 „ 8900	„	„ „ „	„ „	„ „	„	„	„ „ „	33 „	„ „	„	„ „ „	„ „	„ „
8900 „ 9600	„	„ „ „	18 „	„ „	„	·28	„ „ ·28	34×·28	„ ·28	·28	„ „ ·28	18×·28	„ ·28
9600 „ 10300	·28	„ „ ·28	19×·28	„ ·28	55	„	„ „ „	35 „	„ „	„	„ „ „	19 „	„ „
10300 „ 11000	„	„ „ „	20 „	„ „	„	„	„ „ „	36 „	„ „	„	„ „ „	20 „	„ „
11000 „ 11800	„	„ „ „	21 „	„ „	„	·30	„ „ ·30	37×·30	„ ·30	·30	„ „ ·30	21×·30	„ ·30
11800 „ 12600	·30	„ „ „	22 „	„ „	60	„	„ „ „	38 „	8 „	„	„ „ „	22 „	„ „
12600 „ 13600	„	„ „ ·30	23×·30	8×·30	„	·32	„ „ ·32	39×·32	„ ·32	·32	„ „ „	23 „	8 „
13600 „ 14600	„	„ „ „	24 „	„ „	„	„	„ „ „	40 „	„ „	„	„ „ „	24 „	„ „
14600 „ 15800	·32	„ „ „	25 „	„ „	65	·34	„ „ ·34	41×·34	„ ·34	·34	„ „ „	25 „	„ „
15800 „ 17000	„	„ „ „	26 „	„ „	„	„	„ „ „	42 „	„ „	„	„ „ ·32	26×·32	„ ·32
17000 „ 18200	„	„ „ ·32	27×·32	„ ·32	„	·36	„ „ ·36	„ ·36	„ ·36	·36	„ „ „	27 „	„ „
18200 „ 19500	·34	„ „ „	28 „	„ „	70	„	„ „ „	43 „	„ „	„	„ „ „	28 „	„ „
19500 „ 20800	„	„ „ „	29 „	„ „	„	„	„ „ „	„ „	„ „	„	„ „ „	29 „	„ „
20800 „ 22200	„	„ „ „	30 „	„ „	„	·38	„ „ ·38	44×·38	„ ·38	·38	„ „ „	30 „	„ „
22200 „ 23600	„	„ „ „	31 „	„ „	75	„	„ „ „	„ „	9 „	„	„ „ „	31 „	„ „
23600 „ 25000	·36	„ „ „	32 „	9 „	„	„	„ „ „	45 „	„ „	„	„ „ „	32 „	9 „
25000 „ 26400	„	$3\frac{1}{2}\times3\frac{1}{2}\times\cdot34$	„ ·34	„ ·34	„	„	$3\frac{1}{2}\times3\frac{1}{2}$ „	„ „	„ „	„	$3\frac{1}{2}\times3\frac{1}{2}\times\cdot34$	„ ·34	„ ·34
26400 „ 27800	„	„ „ „	33 „	„ „	80	·40	„ „ ·40	38×·40	Dk. Plg. ·26	·40	„ „ „	33 „	„ „
27800 „ 29200	„	„ „ „	„ „	„ „	„	„	„ „ „	„ „	„	„	„ „ „	„ „	„ „

"SHORT" ERECTIONS. TABLE 17.

(Concluded.)

LONGITUDINAL NUMBER. L × (B + D).	"SHORT" ERECTIONS.															
	POOPS.				"SHORT" BRIDGES.					FORECASTLES.						
	Side Plating	Stringer Angle.	Stringer Plate.	Tie Plates.	Maximum Length of "Short" Bridge.	Side Plating	Stringer Angle.	Stringer Plate.	Deck Plating.	Side Plating	Stringer Angle.	Stringer Plate.	Tie Plates and Deck Plating.			
Above / not exceeding	inches.	inches.	inches.	inches.	feet.	inches.	inches.	inches.	inches.	inches.	inches.	inches.	inches.			
29200 and 30600	·38	$3\frac{1}{2} \times 3\frac{1}{2} \times ·34$	$34 \times ·34$	$9 \times ·34$	80	40	$3\frac{1}{2} \times 3\frac{1}{2} \times ·40$	$39 \times ·40$	·26	·40	$3\frac{1}{2} \times 3\frac{1}{2} \times ·34$	$34 \times ·34$	$9 \times ·34$			
30600 „ 32000	„	„ „ „	„ „	„ „	„	„	„ „ „	„ „	·28	„	„ „ „	„ „	„ „			
32000 „ 33400	„	„ „ „	35 „	„ „	85	„	„ „ „	„ „	„	„	„ „ „	35 „	„ „			
33400 „ 34800	„	„ „ ·36	„ ·36	„ ·36	„	·42	„ „ ·42	40 × ·42	„	·42	„ „ ·36	„ ·36	„ ·36			
34800 „ 36200	„	„ „ „	36 „	„ „	„	„	„ „ „	„ „	·30	„	„ „ „	36 „	„ „			
36200 „ 37600	·40	„ „ „	„ „	„ „	„	„	„ „ „	„ „	„	„	„ „ „	„ „	„ „			
37600 „ 39000	„	„ „ „	37 „	„ „	„	„	„ „ „	41 „	„	„	„ „ „	37 „	„ „			
39000 „ 40400	„	„ „ „	„ „	„ „	90	„	„ „ „	„ „	·32	„	„ „ „	„ „	„ „			
40400 „ 41800	„	„ „ „	„ „	10 „	„	„	„ „ „	„ „	„	„	„ „ „	„ „	10 „			
41800 „ 43200	„	„ „ „	38 „	„ „	„	·44	„ „ ·44	42 × ·44	„	·44	„ „ „	38 „	„ „			
43200 „ 44600	„	„ „ ·38	„ ·38	„ ·38	„	„	„ „ „	„ „	·34	„	„ „ ·38	„ ·38	„ ·38			
44600 „ 46000	„	„ „ „	„ „	„ „	„	„	„ „ „	„ „	„	„	„ „ „	„ „	„ „			
46000 „ 47400	·42	„ „ „	39 „	„ „	„	„	„ „ „	43 „	„	„	„ „ „	39 „	„ „			
47400 „ 48800	„	„ „ „	„ „	„ „	„	„	„ „ „	„ „	„	„	„ „ „	„ „	„ „			
48800 „ 50200	„	„ „ „	„ „	„ „	95	„	„ „ „	„ „	·36	„	„ „ „	„ „	„ „			
50200 „ 51600	„	„ „ „	40 „	„ „	„	·46	„ „ ·46	44 × ·46	„	·46	„ „ „	40 „	„ „			
51600 „ 53000	„	„ „ ·40	„ ·40	„ ·40	„	„	„ „ „	„ „	„	„	„ „ ·40	„ ·40	„ ·40			
53000 „ 54400	„	„ „ „	„ „	„ „	„	„	„ „ „	„ „	„	„	„ „ „	„ „	„ „			
54400 „ 55800	„	„ „ „	41 „	„ „	„	„	„ „ „	45 „	·38	„	„ „ „	35 „	Dk. Plg. ·38			
55800 „ 57200	·44	„ „ „	„ „	11 „	„	„	„ „ „	„ „	„	„	„ „ „	„ „	„			
57200 „ 58600	„	„ „ „	„ „	„ „	„	„	„ „ „	„ „	„	„	„ „ „	„ „	„			
58600 „ 60000	„	„ „ „	42 „	„ „	„	·48	„ „ ·48	46 × ·48	„	·48	„ „ „	36 „	„			
60000 „ 61400	„	„ „ „	„ „	„ „	100	„	4 × 4 „	„ „	·40	„	„ „ „	„ „	„			
61400 „ 62800	„	„ „ ·42	„ ·42	„ ·42	„	„	„ „ „	„ „	„	„	„ „ ·42	„ ·42	„			
62800 „ 64200	„	„ „ „	43 „	„ „	„	„	„ „ „	47 „	„	„	„ „ „	37 „	„			
64200 „ 65600	„	„ „ „	„ „	„ „	„	„	„ „ „	„ „	„	„	„ „ „	„ „	„			
65600 „ 67000	·46	„ „ „	„ „	„ „	„	„	„ „ „	„ „	·42	„	„ „ „	„ „	„			
67000 „ 68400	„	„ „ „	44 „	„ „	„	·50	„ „ ·50	48 × ·50	„	·50	„ „ „	38 „	„			
68400 „ 69800	„	„ „ „	„ „	„ „	„	„	„ „ „	„ „	„	„	„ „ „	„ „	„			
69800 „ 71200	„	„ „ „	„ „	„ „	„	„	„ „ „	„ „	„	„	„ „ „	„ „	„			
71200 „ 72600	„	„ „ „	45 „	„ „	105	„	„ „ „	49 „	·44	„	„ „ „	39 „	·40			
72600 „ 74000	„	„ „ ·44	„ ·44	„ ·44	„	„	„ „ „	„ „	„	„	„ „ ·44	„ ·44	„			
74000 „ 75400	„	4 × 4 „	„ „	12 „	„	„	„ „ „	„ „	„	„	4 × 4 „	„ „	„			
75400 „ 76800	·48	„ „ „	„ „	„ „	„	·52	„ „ ·52	50 × ·52	„	·52	„ „ „	„ „	„			
76800 „ 78200	„	„ „ „	46 „	„ „	„	„	„ „ „	„ „	·46	„	„ „ „	40 „	„			
78200 „ 79600	„	„ „ „	„ „	„ „	„	„	„ „ ·58	„ „	„	„	„ „ „	„ „	„			
79600 „ 81000	„	„ „ „	„ „	„ „	„	„	„ „ „	51 „	„	„	„ „ „	„ „	„			

TOPSIDE PLATING, DECK and STRINGER PLATES at UPPER, AWNING or SHELTER DECKS, and "LONG" BRIDGES.

TABLE 18.

(See Continuation.)

LONGITUDINAL NUMBER. L×(B+D).	BREADTH OF SHEERSTRAKE AND STRAKE BELOW.	PROPORTIONS OF LENGTH TO DEPTH.										
		Not exceeding 10.					Above 10 and not exceeding 11.					
		Sheerstrake for ½ length amidships.	Strake below Sheerstrake for ½ length amidships.	Stringer Angle for ½ length amidships.	Stringer Plate for ½ length amidships.	Tie Plates and Deck Plating for ½ length amidships.	Sheerstrake for ½ length amidships	Strake below Sheerstrake for ½ length amidships.	Stringer Angle for ½ length amidships.	Stringer Plate for ½ length amidships.	Tie Plates and Deck Plating for ½ length amidships.
Above / not exceeding	inches.	inches	inches	inches.	inches.	inches.	inches.	inches.	inches.	inches.	inches.
1400 and 1650	30	·24	·24	2½×2½×·24	14×·22	5×·22	·26	·24	2½×2½×·24	16×·22	5×·22
1650 „ 1900	„	·26	„	„ „ „	15 „	6 „	·28	„	„ „ „	17 „	6 „
1900 „ 2150	31	„	·26	„ „ ·26	16×·24	„ ·24	„	·26	„ „ ·26	18×·24	„ ·24
2150 „ 2400	„	·28	„	3×3 „	17 „	„ „	·30	„	3×3 „	19 „	„ „
2400 „ 2650	32	„	·28	„ „ ·28	18×·26	„ ·26	„	·28	„ „ ·28	20×·26	„ ·26
2650 „ 2900	„	·30	„	„ „ „	19 „	„ „	·32	„	„ „ „	21 „	„ „
2900 „ 3150	33	„	·30	„ „ ·30	20×·28	„ ·28	„	·30	„ „ ·30	22×·28	„ ·28
3150 „ 3500	„	·32	„	„ „ „	21 „	7 „	·34	„	„ „ „	23 „	7 „
3500 „ 3850	34	„	·32	„ „ ·32	22×·30	„ ·30	„	·32	„ „ ·32	24×·30	„ ·30
3850 „ 4200	„	·34	„	„ „ „	23 „	„ „	·36	„	„ „ „	25 „	„ „
4200 „ 4600	35	„	·34	„ „ ·34	24×·32	„ ·32	„	·34	„ „ ·34	26×·32	„ ·32
4600 „ 5000	„	·36	„	„ „ „	25 „	8 „	·38	„	„ „ „	27 „	8 „
5000 „ 5400	36	„	·36	„ „ ·36	26×·34	„ ·34	„	·36	„ „ ·36	28×·34	„ ·34
5400 „ 5800	„	·38	„	„ „ „	28 „	„ „	·40	„	„ „ „	30 „	„ „
5800 „ 6300	37	„	·38	„ „ ·38	30×·36	„ ·36	„	·38	„ „ ·38	32×·36	„ ·36
6300 „ 6800	„	·40	„	„ „ „	32 „	9 „	·42	„	„ „ „	34 „	9 „
6800 „ 7300	38	„	·40	„ „ ·40	34×·38	„ ·38	·44	·40	„ „ ·40	36×·38	„ ·38
7300 „ 7900	„	·42	„	„ „ „	36 „	10 „	„	„	„ „ „	38 „	10 „
7900 „ 8500	39	„	·42	„ „ ·42	38×·40	„ ·40	·46	·42	„ „ ·42	40×·40	„ ·40
8500 „ 9200	„	·44	„	3½×3½ „	40 „	11 „	„	„	3½×3½ „	42 „	11 „
9200 „ 9900	40	„	·44	„ „ ·44	42×·42	„ ·42	·48	·44	„ „ ·44	44×·42	„ ·42
9900 „ 10600	„	·46	„	„ „ „	44 „	12 „	„	„	„ „ „	46 „	12 „
10600 „ 11400	41	„	·46	„ „ ·46	46×·44	„ ·44	·50	·46	„ „ ·46	48×·44	„ ·44
11400 „ 12200	„	·48	„	4×4 „	48 „	13 „	„	„	4×4 „	50 „	13 „
12200 „ 13100	42	„	·48	„ „ ·48	50×·46	„ ·46	·52	·48	„ „ ·48	52×·46	„ ·46
13100 „ 14100	„	·50	„	„ „ „	52 „	14 „	„	„	„ „ „	54 „	14 „
14100 „ 15200	„	„	·50	„ „ „	54×·48	„ ·48	·54	·50	„ „ „	56×·48	„ ·48
15200 „ 16400	43	·52	„	4½×4½ „	56 „	15 „	„	„	4½×4½ „	42 „	Dk·30 for ½L
16400 „ 17600	„	„	·52	„ „ ·50	41×·48	Dk·30 for ½L.	·56	·52	„ „ ·50	43 „	„
17600 „ 18800	„	·54	„	„ „ „	42×·48	„	·58	„	„ „ „	44×·50	„
18800 „ 20100	44	„	·54	„ „ ·52	43 „	„	„	·54	„ „ ·52	45 „	Cmpl.·30 deck.
20100 „ 21500	„	·56	„	„ „ „	44 „	Cmpl.·30 deck.	·60	„	„ „ „	46 „	„
21500 „ 22900	„	„	·56	„ „ ·54	45 „	„	„	·56	„ „ ·54	47 „	·32
22900 „ 24300	45	·58	„	„ „ „	46×·50	„	·62	„	„ „ „	48×·52	„
24300 „ 25700	„	„	·58	„ „ ·56	47 „	·32	„	·58	„ „ ·56	49 „	·34
25700 „ 27100	„	·60	„	„ „ „	48 „	„	·64	„	„ „ „	50 „	„
27100 „ 28500	46	„	·60	„ „ „	49 „	·34	„	·60	„ „ „	51 „	·36
28500 „ 29900	„	·62	„	„ „ „	50 „	„	·66	„	„ „ „	52×·54	„

The topside scantlings and decks before and abaft a bridge are to be determined by the vessel's proportions taken to the upper deck. These scantlings are to be maintained throughout the length of a "short" bridge, and are to be extended within the ends of a "long" bridge for a distance equal to one-third the breadth of the vessel.

The upper deck stringer angles in the above Table may be gradually reduced at the ends of the vessel to the size given in Table 17 for upper deck stringer angles at ends in way of erections.

TOPSIDE PLATING, DECK and STRINGER PLATES at UPPER AWNING or SHELTER DECKS, and "LONG" BRIDGES.

TABLE 18.

(See Continuation.)

LONGITUDINAL NUMBER. L×(B+D).	BREADTH OF SHEERSTRAKE AND STRAKE BELOW.	PROPORTIONS OF LENGTH TO DEPTH.				
		Not exceeding 10.				
		Sheerstrake for ½ length amidships.	Strake below Sheerstrake for ½ length amidships.	Stringer Angle for ½ length amidships.	Stringer Plate for ½ length amidships.	Deck Plating for ½ length amidships.
Above and not exceeding	inches.	inches.	inches.	inches.	inches.	inches.
29900 and 31300	46	·62	·62	$4\frac{1}{2}\times4\frac{1}{2}\times\cdot58$	51×·52	·36
31300 „ 32700	47	·64	„	„ „ „	52 „	„
32700 „ 34100	„	„	·64	„ „ ·60	53 „	·38
34100 „ 35500	„	·66	„	5 ×5 „	54 „	„
35500 „ 36900	48	„	„	„ „ ·62	55 „	·40
36900 „ 38300	„	·68	·66	„ „ „	56×·54	„
38300 „ 39700	„	„	„	„ „ ·64	57 „	„
39700 „ 41100	49	·70	·68	„ „ „	58 „	·42
41100 „ 42500	„	„	„	„ „ „	59 „	„
42500 „ 43900	„	·72	„	„ „ „	60 „	„
43900 „ 45300	50	„	·70	„ „ ·66	61×·56	·44
45300 „ 46700	„	·74	„	„ „ „	62 „	„
46700 „ 48100	„	„	·72	„ „ ·68	63 „	„
48100 „ 49500	51	·76	„	„ „ „	64 „	·46
49500 „ 50900	„	„	„	„ „ ·70	65×·58	„
50900 „ 52300	„	·78	·74	„ „ „	66 „	„
52300 „ 53700	52	„	„	„ „ ·72	2 at 48 „	·48
53700 „ 55100	„	·80	·76	„ „ „	„ „ ·60	„
55100 „ 56500	„	„	„	„ „ „	„ 49 „	„
56500 „ 57900	53	·82	„	„ „ „	„ „ ·62	·50
57900 „ 59300	„	„	·78	„ „ ·74	„ 50 „	„
59300 „ 60700	„	·84	„	6 ×6 „	„ „ ·64	„
60700 „ 62100	54	„	·80	„ „ ·76	„ 51 „	·52
62100 „ 63500	„	·86	„	„ „ „	„ „ ·66	„
63500 „ 64900	„	„	„	„ „ ·78	„ 52 „	·54
64900 „ 66300	55	·88	·82	„ „ „	„ „ ·68	·56
66300 „ 67700	„	„	„	„ „ ·80	„ 53 „	„
67700 „ 69100	„	·90	·84	„ „ „	„ „ ·70	·58
69100 „ 70500	56	„	„	„ „ „	„ 54 „	·60
70500 „ 71900	„	·92	„	„ „ „	„ „ ·72	„
71900 „ 73300	„	·94	·86	„ „ ·82	„ 55 „	·62
73300 „ 74700	57	„	„	„ „ „	„ „ ·74	·64
74700 „ 76100	„	·96	·88	„ „ ·84	„ 56 „	„
76100 „ 77500	„	·98	„	7 ×7 „	„ „ ·76	·66
77500 „ 78900	58	„	„	„ „ ·86	„ 57 „	·68
78900 „ 80300	„	1·00	·90	„ „ „	„ „ ·78	„
80300 „ 81700	„	1·02	„	„ „ „	„ 58 „	·70

LONGITUDINAL NUMBER. L×(B+D).	BREADTH OF SHEERSTRAKE AND STRAKE BELOW.	PROPORTIONS OF LENGTH TO DEPTH.				
		Above 10 and not exceeding 11.				
		Sheerstrake for ½ length amidships.	Strake below Sheerstrake for ½ length amidships.	Stringer Angle for ½ length amidships.	Stringer Plate for ½ length amidships.	Deck Plating for ½ length amidships.
Above and not exceeding	inches.	inches.	inches.	inches.	inches.	inches.
29900 and 31300	46	·66	·62	$4\frac{1}{2}\times4\frac{1}{2}\times\cdot58$	53×·54	·38
31300 „ 32700	47	·68	„	5 ×5 „	54 „	„
32700 „ 34100	„	„	·64	„ „ ·60	55 „	·40
34100 „ 35500	„	·70	„	„ „ „	56×·56	„
35500 „ 36900	48	„	·66	„ „ ·62	57 „	„
36900 „ 38300	„	·72	„	„ „ „	58 „	·42
38300 „ 39700	„	„	·68	„ „ ·64	59 „	„
39700 „ 41100	49	·74	„	„ „ „	60×·58	„
41100 „ 42500	„	„	·70	„ „ „	61 „	·44
42500 „ 43900	„	·76	„	„ „ „	62 „	„
43900 „ 45300	50	„	·72	„ „ ·66	63 „	„
45300 „ 46700	„	·78	„	„ „ „	64×·60	·46
46700 „ 48100	„	„	·74	„ „ ·68	65 „	„
48100 „ 49500	51	·80	„	„ „ „	66 „	„
49500 „ 50900	„	·82	·76	„ „ ·70	2 at 48×·62	·48
50900 „ 52300	„	„	„	„ „ „	„ „ „	„
52300 „ 53700	52	·84	·78	„ „ ·72	„ 49 „	„
53700 „ 55100	„	·86	„	„ „ „	„ „ ·64	·50
55100 „ 56500	„	„	·80	6 ×6 „	„ 50 „	„
56500 „ 57900	53	·88	„	„ „ „	„ „ ·66	„
57900 „ 59300	„	·90	·82	„ „ ·74	„ 51 „	·52
59300 „ 60700	„	„	„	„ „ „	„ „ ·68	„
60700 „ 62100	54	·92	·84	„ „ ·76	„ 52 „	·54
62100 „ 63500	„	·94	„	„ „ „	„ „ ·70	·56
63500 „ 64900	„	„	·86	„ „ ·78	„ 53 „	„
64900 „ 66300	55	·96	„	„ „ „	„ „ ·72	·58
66300 „ 67700	„	·98	·88	„ „ ·80	„ 54 „	·60
67700 „ 69100	„	„	„	7 ×7 „	„ „ ·74	„
69100 „ 70500	56	1·00	·90	„ „ „	„ 55 „	·62
70500 „ 71900	„	1·02	„	„ „ „	„ „ ·76	·64
71900 „ 73300	„	„	·92	„ „ ·82	„ 56 „	„
73300 „ 74700	57	1·04	„	„ „ „	„ „ ·78	·66
74700 „ 76100	„	1·06	·94	„ „ ·84	„ 57 „	·68
76100 „ 77500	„	„	„	8 ×8 „	„ „ ·80	„
77500 „ 78900	58	1·08	·96	„ „ ·86	„ 58 „	·70
78900 „ 80300	„	1·10	„	„ „ „	„ „ ·82	·72
80300 „ 81700	„	„	·98	„ „ „	„ 59 „	„

The topside scantlings and decks before and abaft a bridge are to be determined by the vessel's proportions taken to the upper deck. These scantlings are to be maintained throughout the length of a "short" bridge, and are to be extended within the ends of a "long" bridge for a distance equal to one-third the breadth of the vessel.

The upper deck stringer angles in the above Table may be gradually reduced at the ends of the vessel to the size given in Table 17 for upper deck stringer angles at ends in way of erections.

TOPSIDE PLATING, DECK and STRINGER PLATES at UPPER, AWNING or SHELTER DECKS, and "LONG" BRIDGES.

TABLE **18.**

(See Continuation.)

LONGITUDINAL NUMBER. L×(B+D).	PROPORTIONS OF LENGTH TO DEPTH.									
	Above 11 and not exceeding 12.					Above 12 and not exceeding 13.				
	Sheerstrake for ½ length amidships.	Strake below Sheerstrake for ½ length amidships.	Stringer Angle for ½ length amidships.	Stringer Plate for ½ length amidships.	Tie Plates and Deck Plating for ½ length amidships.	Sheerstrake for ½ length amidships.	Strake below Sheerstrake for ½ length amidships.	Stringer Angle for ½ length amidships.	Stringer Plate for ½ length amidships.	Tie Plates and Deck Plating for ½ length amidships.
Above / not exceeding	inches.	inches.	inches.	inches.	inches.	inches.	inches.	inches.	inches.	inches.
1400 and 1650	·28	·24	$2\frac{1}{2}\times2\frac{1}{2}\times\cdot24$	18×·24	5×·24	·30	·24	$2\frac{1}{2}\times2\frac{1}{2}\times\cdot28$	20×·26	5×·26
1650 „ 1900	·30	„	„ „ „	19 „	6 „	·32	„	3×3 „	21 „	6 „
1900 „ 2150	„	·26	„ „ ·26	20×·26	„ ·26	„	·26	„ „ ·30	22×·28	„ ·28
2150 „ 2400	·32	„	3×3 „	21 „	„ „	·34	„	„ „ „	23 „	„ „
2400 „ 2650	„	·28	„ „ ·28	22×·28	„ ·28	·36	·28	„ „ ·32	24×·30	„ ·30
2650 „ 2900	·34	„	„ „ „	23 „	„ „	·38	„	„ „ „	25 „	„ „
2900 „ 3150	„	·30	„ „ ·30	24×·30	„ ·30	„	·30	„ „ ·34	26×·32	„ ·32
3150 „ 3500	·36	„	„ „ „	25 „	7 „	·40	„	„ „ „	27 „	7 „
3500 „ 3850	„	·32	„ „ ·32	26×·32	„ ·32	„	·32	„ „ ·36	28×·34	„ ·34
3850 „ 4200	·38	„	„ „ „	27 „	„ „	·42	„	„ „ „	29 „	„ „
4200 „ 4600	·40	·34	„ „ ·34	28×·34	„ ·34	„	·34	„ „ ·38	30×·36	8×·36
4600 „ 5000	„	„	„ „ „	29 „	8 „	·44	„	„ „ „	31 „	„ „
5000 „ 5400	·42	·36	„ „ ·36	30×·36	„ ·36	·46	·36	„ „ ·40	32×·38	„ ·38
5400 „ 5800	·44	„	„ „ „	32 „	„ „	„	„	„ „ „	34 „	9 „
5800 „ 6300	„	·38	„ „ ·38	34×·38	„ ·38	·48	·38	$3\frac{1}{2}\times3\frac{1}{2}\times\cdot42$	36×·40	„ ·40
6300 „ 6800	·46	„	„ „ „	36 „	9 „	·50	„	„ „ „	38 „	10 „
6800 „ 7300	„	·40	„ „ ·40	38×·40	„ ·40	„	·40	„ „ ·44	40×·42	„ ·42
7300 „ 7900	·48	„	$3\frac{1}{2}\times3\frac{1}{2}$ „	40 „	10 „	·52	·42	„ „ „	42 „	11 „
7900 „ 8500	„	·42	„ „ ·42	42×·42	11×·42	„	„	„ „ „	44×·44	„ ·44
8500 „ 9200	·50	„	„ „ „	44 „	„ „	·54	·44	„ „ ·46	46 „	12 „
9200 „ 9900	·52	·44	„ „ ·44	46×·44	12×·44	·56	„	„ „ „	48×·46	„ ·46
9900 „ 10600	„	„	„ „ „	48 „	„ „	„	·46	„ „ ·48	50 „	13 „
10600 „ 11400	·54	·46	„ „ ·46	50×·46	13×·46	·58	„	4×4 „	52×·48	„ ·48
11400 „ 12200	„	„	4×4 „	52 „	„ „	·60	·48	„ „ ·50	54×·50	14×·50
12200 „ 13100	·56	·48	„ „ ·48	54×·48	14×·48	·62	„	„ „ „	43 „	Dk·30 for ½L.
13100 „ 14100	·58	„	„ „ „	56 „	„ „	·64	·50	„ „ ·52	44×·52	„ „
14100 „ 15200	„	·50	„ „ „	43×·50	Dk·30 for ½L.	„	·52	„ „ „	45 „	„ „
15200 „ 16400	·60	„	$4\frac{1}{2}\times4\frac{1}{2}$ „	44 „	„ „	·66	„	$4\frac{1}{2}\times4\frac{1}{2}$ „	46 „	Cmpl.·30 deck.
16400 „ 17600	·62	·52	„ „ ·50	45 „	„ „	·68	·54	„ „ ·54	47×·54	·32
17600 „ 18800	„	„	„ „ „	46×·52	Cmpl.·30 deck.	·70	„	„ „ „	48 „	„
18800 „ 20100	·64	·54	„ „ ·52	47 „	·32	·72	·56	„ „ ·56	49 „	·34
20100 „ 21500	·66	„	„ „ „	48 „	„	·74	„	„ „ „	50×·56	„
21500 „ 22900	„	·56	„ „ ·54	49 „	·34	·76	·58	„ „ ·58	51 „	·36
22900 „ 24300	·68	·58	„ „ „	50×·54	„	„	·60	„ „ ·60	52 „	„
24300 „ 25700	„	„	„ „ ·56	51 „	·36	·78	„	„ „ „	53×·58	·38
25700 „ 27100	·70	·60	„ „ „	52 „	„	·80	·62	„ „ ·62	54 „	„
27100 „ 28500	·72	·62	„ „ „	53 „	·38	·82	·64	„ „ „	55 „	·40
28500 „ 29900	„	„	„ „ „	54×·56	„	·84	·66	5×5×·64	56×·60	„

The topside scantlings and decks before and abaft a bridge are to be determined by the vessel's proportions taken to the upper deck. These scantlings are to be maintained throughout the length of a "short" bridge, and are to be extended within the ends of a "long" bridge for a distance equal to one-third the breadth of the vessel.

The upper deck stringer angles in the above Table may be gradually reduced at the ends of the vessel to the size given in Table 17 for upper deck stringer angles at ends in way of erections.

TOPSIDE PLATING, DECK and STRINGER PLATES at UPPER, AWNING or SHELTER DECKS, and "LONG" BRIDGES.

TABLE **18.**

(See Continuation.)

LONGITUDINAL NUMBER. L×(B+D).	PROPORTIONS OF LENGTH TO DEPTH.									
	Above 11 and not exceeding 12.					Above 12 and not exceeding 13.				
	Sheerstrake for ½ length amidships.	Strake below Sheerstrake for ½ length amidships.	Stringer Angle for ½ length amidships.	Stringer Plate for ½ length amidships.	Deck Plating for ½ length amidships.	Sheerstrake for ½ length amidships.	Strake below Sheerstrake for ½ length amidships.	Stringer Angle for ½ length amidships.	Stringer Plate for ½ length amidships.	Deck Plating for ½ length amidships.
Above not exceeding	inches.	inches.	inches.	inches.	inches.	inches.	inches.	inches.	inches.	inches.
29900 and 31300	·74	·64	5 × 5 × ·58	55 × ·56	·40	·86	·68	5 × 5 × ·64	57 × ·60	·42
31300 „ 32700	·76	·66	„ „ „	56 „	„	·88	·70	„ „ ·66	58 „	„
32700 „ 34100	„	„	„ „ ·60	57 × ·58	„	„	·72	„ „ „	59 × ·62	„
34100 „ 35500	·78	·68	„ „ „	58 „	·42	·90	·74	„ „ ·68	60 „	·44
35500 „ 36900	„	·70	„ „ ·62	59 „	„	·92	„	„ „ ·70	61 „	„
36900 „ 38300	·80	„	„ „ „	60 × ·60	„	„	·76	„ „ „	62 × ·64	„
38300 „ 39700	·82	·72	„ „ ·64	61 „	·44	·94	·78	„ „ ·72	63 „	·46
39700 „ 41100	„	·74	„ „ „	62 „	„	·96	·80	„ „ „	64 „	„
41100 „ 42500	·84	„	„ „ „	63 × ·62	„	„	„	„ „ ·74	65 × ·66	„
42500 „ 43900	·86	·76	„ „ „	64 „	·46	·98	·82	„ „ „	66 „	·48
43900 „ 45300	„	·78	„ „ ·66	65 „	„	1·00	·84	„ „ ·76	2 at 48 ·68	„
45300 „ 46700	·88	„	„ „ „	66 × ·64	„	1·02	·86	„ „ „	„ „ ·70	„
46700 „ 48100	·90	·80	„ „ ·68	2 at 48 „	·48	1·04	·88	6 × 6 „	„ 49 „	·50
48100 „ 49500	„	·82	„ „ „	„ „ ·66	„	„	·90	„ „ ·78	„ „ ·72	„
49500 „ 50900	·92	„	„ „ ·70	„ 49 „	„	1·06	·92	„ „ „	„ 50 „	„
50900 „ 52300	·94	·84	6 × 6 „	„ „ ·68	·50	1·08	·94	„ „ „	„ „ ·74	·52
52300 „ 53700	„	·86	„ „ ·72	„ 50 „	„	„	·96	„ „ ·80	„ 51 „	„
53700 „ 55100	·96	„	„ „ „	„ „ ·70	·52	1·10	·98	„ „ „	„ „ ·76	„
55100 „ 56500	·98	·88	„ „ „	„ 51 „	„	1·12	1·00	„ „ „	„ 52 „	·54
56500 „ 57900	„	·90	„ „ „	„ „ ·72	·54	„	1·02	„ „ ·82	„ „ ·78	„
57900 „ 59300	1·00	„	„ „ ·74	„ 52 „	„	1·14	1·04	„ „ „	„ 53 „	·56
59300 „ 60700	1·02	·92	„ „ „	„ „ ·74	·56	1·16	1·06	7 × 7 „	„ „ ·80	„
60700 „ 62100	1·04	·94	„ „ ·76	„ 53 „	„	1·18	1·08	„ „ ·84	„ 54 „	·58
62100 „ 63500	1·06	„	7 × 7 „	„ „ ·76	·58	1·20	1·10	„ „ „	„ „ ·82	„
63500 „ 64900	„	·96	„ „ ·78	„ 54 × ·78	„	·90 Dbld.	·86	„ „ „	„ 55 × ·84	·60
64900 „ 66300	1·08	·98	„ „ „	„ „ „	·60	·92 „	·88	„ „ „	„ „ „	·62
66300 „ 67700	1·10	„	„ „ ·80	„ 55 × ·80	„	„ „	·90	„ „ „	„ 56 × ·86	„
67700 „ 69100	„	1·00	„ „ „	„ „ ·82	·62	·94 „	„	„ „ ·86	„ „ ·88	·64
69100 „ 70500	1·12	1·02	„ „ „	„ 56 „	·64	·96 „	·92	8 × 8 „	„ 57 „	·66
70500 „ 71900	1·14	„	„ „ „	„ „ ·84	„	„ „	·94	„ „ ·88	„ „ ·90	„
71900 „ 73300	„	1·04	„ „ ·82	„ 57 × ·86	·66	·98 „	„	„ „ „	„ 58 × ·92	·68
73300 „ 74700	1·16	1·06	8 × 8 „	„ „ „	·68	1·00 „	·96	„ „ ·90	„ „ „	·70
74700 „ 76100	1·18	„	„ „ ·84	„ 58 × ·88	„	„ „	·98	„ „ „	„ 59 × ·94	·72
76100 „ 77500	„	1·08	„ „ „	„ „ ·90	·70	1·02 „	„	„ „ ·92	„ „ ·96	„
77500 „ 78900	1·20	1·10	„ „ ·86	„ 59 „	·72	1·04 „	1·00	„ „ „	„ 60 „	·74
78900 „ 80300	·90 Dbld	·90	„ „ „	„ „ ·92	„	„ „	1·02	„ „ ·94	„ „ ·98	„
80300 „ 81700	·92 „	„	„ „ „	„ 60 × ·94	·74	1·06 „	„	„ „ „	„ 61 × 1·00	·76

The topside scantlings and decks before and abaft a bridge are to be determined by the vessel's proportions taken to the upper deck. These scantlings are to be maintained throughout the length of a "short" bridge, and are to be extended within the ends of a "long" bridge for a distance equal to one-third the breadth of the vessel.

The upper deck stringer angles in the above Table may be gradually reduced at the ends of the vessel to the size given in Table 17 for upper deck stringer angles at ends in way of erections.

TOPSIDE PLATING, DECK and STRINGER PLATES at UPPER, AWNING or SHELTER DECKS, and "LONG" BRIDGES.

TABLE **18.**

(See Continuation.)

LONGITUDINAL NUMBER. L × (B + D).	PROPORTIONS OF LENGTH TO DEPTH. Above 13 and not exceeding 14.					THICKNESS OF UPPER DECK UNDER "LONG" BRIDGES.		THICKNESS OF SHEER-STRAKE AND STRAKE BELOW AT ENDS.	BEAM STRINGERS AT ENDS OF UPPER, AWNING OR SHELTER DECKS, ALSO THICKNESS OF TIE PLATES AT ENDS.	THICKNESS OF DECK PLATING AT ENDS OF UPPER, AWNING OR SHELTER DECKS.
	Sheerstrake for $\frac{1}{2}$ length amidships.	Strake below Sheerstrake for $\frac{1}{2}$ length amidships.	Stringer Angle for $\frac{1}{2}$ length amidships.	Stringer Plate for $\frac{1}{2}$ length amidships.	Tie Plates and Deck Plating for $\frac{1}{2}$ length amidships.	Stringer Plate.	Tie Plates and Deck Plating.			
Above — not exceeding	inches.	inches.	inches.	inches.	inches.	inches.	inches.	inches.	inches.	inches.
1400 and 1650	·32	·24	3 × 3 × ·32	22 × ·28	6 × ·28	·22	·22	·24	10 × ·22	
1650 „ 1900	·34	„	„ „ „	23 „	„ „	„	„	„	11 „	
1900 „ 2150	·36	·26	„ „ ·34	24 × ·30	„ ·30	·24	·24	„	„ „	
2150 „ 2400	·38	„	„ „ „	25 „	„ „	„	„	„	„ ·24	
2400 „ 2650	·40	·28	„ „ ·36	26 × ·32	„ ·32	„	„	„	12 „	
2650 „ 2900	„	„	„ „ „	27 „	„ „	·26	·26	„	„ „	
2900 „ 3150	·42	·30	„ „ ·38	28 × ·34	7 × ·34	„	„	·26	„ „	
3150 „ 3500	·44	„	„ „ „	29 „	„ „	„	„	„	13 × ·26	
3500 „ 3850	„	·32	„ „ ·40	30 × ·36	„ ·36	·28	·28	„	„ „	
3850 „ 4200	·46	„	„ „ „	31 „	„ „	„	„	„	„ „	
4200 „ 4600	·48	·34	$3\frac{1}{2} \times 3\frac{1}{2} \times ·42$	32 × ·38	8 × ·38	„	„	·28	14 × ·28	
4600 „ 5000	„	·36	„ „ „	33 „	„ „	·30	·30	„	„ „	
5000 „ 5400	·50	„	„ „ ·44	34 × ·40	9 × ·40	„	„	·30	„ „	
5400 „ 5800	·52	·38	„ „ „	36 „	„ „	„	„	„	15 × ·30	
5800 „ 6300	„	·40	„ „ ·46	38 × ·42	10 × ·42	·32	·32	·32	„ „	
6300 „ 6800	·54	„	„ „ „	40 „	„ „	„	„	„	16 „	
6800 „ 7300	·56	·42	„ „ ·48	42 × ·44	11 × ·44	„	„	·34	„ ·32	
7300 „ 7900	„	·44	„ „ „	44 „	„ „	·34	·34	„	17 „	
7900 „ 8500	·58	„	„ „ ·50	46 × ·46	12 × ·46	„	„	·36	„ „	
8500 „ 9200	·60	·46	„ „ „	48 „	„ „	„	„	„	18 × ·34	
9200 „ 9900	·62	·48	4 × 4 × ·52	50 × ·48	13 × ·48	·36	·36	„	19 „	
9900 „ 10600	·64	„	„ „ „	42 × ·48	Dk ·30 for $\frac{1}{2}$ L.	·36	Dk. ·30 pltg	·38	20 „	
10600 „ 11400	·66	·50	„ „ ·54	43 × ·50	„ „	·38	„	„	21 „	
11400 „ 12200	·68	·52	„ „ „	44 „	„ „	·40	„	„	22 × ·36	
12200 „ 13100	·70	·54	„ „ ·56	45 × ·52	Cmpl ·30 deck	·42	„	·40	23 „	·30
13100 „ 14100	·72	„	$4\frac{1}{2} \times 4\frac{1}{2}$ „	46 „	„	·44	„	„	24 „	„
14100 „ 15200	·74	·56	„ „ ·58	47 × ·54	·32	„	„	„	25 „	„
15200 „ 16400	·76	·58	„ „ „	48 „	·34	„	„	„	26 × ·38	„
16400 „ 17600	·78	·60	„ „ ·60	49 × ·56	·36	„	„	„	27 „	„
17600 „ 18800	·80	„	„ „ „	50 „	·38	„	„	„	28 „	„
18800 „ 20100	·82	·62	„ „ „	51 × ·58	„	·46	„	·42	29 „	„
20100 „ 21500	·84	·64	„ „ ·62	52 „	·40	„	„	„	30 × ·40	„
21500 „ 22900	·86	·66	„ „ „	53 × ·60	„	„	„	„	31 „	„
22900 „ 24300	·88	„	„ „ ·64	54 „	„	„	„	„	32 „	„
24300 „ 25700	·90	·68	„ „ „	55 × ·62	·42	„	·32	·44	„ „	·32
25700 „ 27100	·92	·70	„ „ ·66	56 „	„	„	„	„	33 × ·42	„
27100 „ 28500	·94	·72	5 × 5 „	57 × ·64	„	„	·34	„	„ „	„
28500 „ 29900	·96	·74	„ „ „	58 „	·44	„	„	„	34 „	„

The topside scantlings and decks before and abaft a bridge are to be determined by the vessel's proportions taken to the upper deck. These scantlings are to be maintained throughout the length of a "short" bridge, and are to be extended within the ends of a "long" bridge for a distance equal to one-third the breadth of the vessel.

The upper deck stringer angles in the above Table may be gradually reduced at the ends of the vessel to the size given in Table 17 for upper deck stringer angles at ends in way of erections.

TOPSIDE PLATING, DECK and STRINGER PLATES at UPPER, AWNING or SHELTER DECKS, and "LONG" BRIDGES.

TABLE 18.
(Concluded.)

LONGITUDINAL NUMBER. L×(B+D).	PROPORTIONS OF LENGTH TO DEPTH. Above 13 and not exceeding 14.					THICKNESS OF UPPER DECK UNDER "LONG" BRIDGES.		THICKNESS OF SHEER-STRAKE AND STRAKE BELOW AT ENDS.	BEAM STRINGERS AT ENDS OF UPPER, AWNING OR SHELTER DECKS, ALSO THICKNESS OF TIE PLATES AT ENDS.	THICKNESS OF DECK PLATING AT ENDS OF UPPER AWNING OR SHELTER DECKS.
	Sheerstrake for $\frac{1}{2}$ length amidships.	Strake below Sheerstrake for $\frac{1}{2}$ length amidships.	Stringer Angle for $\frac{1}{2}$ length amidships.	Stringer Plate for $\frac{1}{2}$ length amidships.	Deck Plating for $\frac{1}{2}$ length amidships.	Stringer Plates.	Deck Plating.			
Above — not exceeding	inches.	inches.	inches.	inches.	inches.	inches.	inches.	inches.	inches.	inches.
29900 and 31300	·98	·76	5 × 5 × ·68	59 × ·64	·44	·48	·36	·44	34 × ·42	·34
31300 „ 32700	1·00	·78	„ „ „	60 × ·66	„	„	„	„	35 × ·44	„
32700 „ 34100	1·02	·80	„ „ ·70	61 „	·46	„	„	·46	„ „	„
34100 „ 35500	1·04	·82	„ „ „	62 „	„	„	·38	„	36 „	„
35500 „ 36900	1·06	·84	„ „ „	63 × ·68	„	„	„	„	„ „	·36
36900 „ 38300	1·08	·86	„ „ ·72	64 „	„	„	„	„	37 „	„
38300 „ 39700	1·10	·88	„ „ „	65 „	·48	„	·40	„	„ „	„
39700 „ 41100	1·12	·90	„ „ „	66 × ·70	„	·50	„	·48	„ „	„
41100 „ 42500	1·14	·92	„ „ ·74	2 at 48 × ·72	„	„	„	„	38 „	„
42500 „ 43900	1·16	·94	6 × 6 „	„ „ ·74	·50	„	„	„	„ „	„
43900 „ 45300	1·18	·96	„ „ „	„ 49 „	„	„	·42	„	„ „	„
45300 „ 46700	1·20	·98	„ „ ·76	„ „ ·76	„	„	„	„	39 „	„
46700 „ 48100	·90 Dbld.	·82	„ „ „	„ 50 „	·52	„	„	·50	„ „	„
48100 „ 49500	„ „	„	„ „ „	„ „ ·78	„	·52	„	„	„ ·46	„
49500 „ 50900	·92	·84	„ „ ·78	„ 51 „	„	„	„	„	40 „	„
50900 „ 52300	„ „	·86	„ „ „	„ „ ·80	·54	„	„	„	„ „	„
52300 „ 53700	·94 „	„	„ „ ·80	„ 52 „	„	„	·44	„	„ „	„
53700 „ 55100	·96 „	·88	„ „ „	„ „ ·82	·56	„	„	·52	41 „	·38
55100 „ 56500	„ „	·90	7 × 7 „	„ 53 „	„	„	„	„	„ „	„
56500 „ 57900	·98 „	„	„ „ ·82	„ „ ·84	·58	·54	„	„	„ „	„
57900 „ 59300	1·00 „	·92	„ „ „	„ 54 „	„	„	·46	„	42 „	„
59300 „ 60700	„ „	·94	„ „ „	„ „ ·86	·60	„	„	„	„ „	„
60700 „ 62100	1·02 „	„	„ „ ·84	„ 55 „	·62	„	„	·54	„ „	„
62100 „ 63500	1·04 „	·96	„ „ „	„ „ ·88	„	„	„	„	43 × ·48	„
63500 „ 64900	„ „	·98	„ „ ·86	„ 56 × ·90	·64	„	·48	„	„ „	„
64900 „ 66300	1·06 „	„	„ „ „	„ „ „	·66	·56	„	·56	„ „	„
66300 „ 67700	1·08 „	1·00	8 × 8 „	„ 57 × ·92	„	„	„	„	44 „	„
67700 „ 69100	„ „	1·02	„ „ ·88	„ „ ·94	·68	„	·50	„	„ „	„
69100 „ 70500	1·10 „	„	„ „ „	„ 58 „	·70	„	„	„	„ „	„
70500 „ 71900	1·12 „	1·04	„ „ „	„ „ ·96	„	·58	„	„	45 „	·40
71900 „ 73300	„ „	1·06	„ „ ·90	„ 59 × ·98	·72	„	·52	·58	„ ·50	„
73300 „ 74700	1·14 „	„	„ „ „	„ „ „	·74	„	„	„	„ „	„
74700 „ 76100	1·16 „	1·08	„ „ „	„ 60 × 1·00	„	·60	„	„	„ „	„
76100 „ 77500	„ „	1·10	„ „ ·92	„ „ 1·02	·76	„	·54	„	46 „	„
77500 „ 78900	1·18 „	„	„ „ „	„ 61 „	·78	„	„	„	„ „	„
78900 „ 80300	1·20 „	1·12	„ „ „	„ „ 1·04	„	·62	„	·60	„ „	„
80300 „ 81700	„ „	1·14	„ „ ·94	„ 62 × 1·06	·80	„	·56	„	„ „	„

The topside scantlings and decks before and abaft a bridge are to be determined by the vessel's proportions taken to the upper deck. These scantlings are to be maintained throughout the length of a "short" bridge, and are to be extended within the ends of a "long" bridge for a distance equal to one-third the breadth of the vessel.

The upper deck stringer angles in the above Table may be gradually reduced at the ends of the vessel to the size given in Table 17 for upper deck stringer angles at ends in way of erections.

LLOYD'S REGISTER OF SHIPPING, LONDON.—*13th June, 1912.*

Diameters and spacing of RIVETS and breadths of BUTT STRAPS, BUTT LAPS, and EDGE LAPS.

BUTT STRAPS. TABLE 19.

		inches.	inches. Above	inches. Above	inches. Above	inches. Above	inches. Above
Thickness of Plates		·22 and not exceeding ·34	·34 and not exceeding ·48	·48 and not exceeding ·66	·66 and not exceeding ·88	·88 and not exceeding 1·14	1·14 to 1·20
Diameter of Rivets		$\frac{5}{8}$	$\frac{3}{4}$	$\frac{7}{8}$	1	$1\frac{1}{8}$	$1\frac{1}{4}$
Breadth of Quadruple riveted Butt Straps in inches		...	...	22	25	$28\frac{1}{4}$	$31\frac{1}{2}$
Breadth of Treble riveted Butt Straps in inches		...	$14\frac{1}{4}$	$16\frac{3}{4}$	19	$21\frac{1}{2}$	24
Breadth of Double riveted Butt Straps in inches		8	$9\frac{3}{4}$	$11\frac{1}{4}$	...	...	...
Breadth of Single riveted Butt Straps in inches		$4\frac{1}{2}$	$5\frac{1}{4}$	...	...	...	...
Breadth of Quadruple riveted Butt Laps in inches		...	...	12	14	16	18
Breadth of Treble riveted Butt Laps in inches		...	$7\frac{1}{2}$	9	$10\frac{1}{2}$	12	$13\frac{1}{2}$
Breadth of Double riveted Butt Laps in inches		$4\frac{1}{4}$	5	6	...	...	...
Breadth of Single riveted Butt Laps in inches		$2\frac{1}{2}$	3	...	...	...	...
Breadth of Treble riveted Edge Laps in inches		...	...	...	$8\frac{1}{2}$	$9\frac{1}{2}$	$10\frac{1}{2}$
Breadth of Double riveted Edge Laps in inches		$3\frac{3}{4}$	$4\frac{1}{2}$	$5\frac{1}{4}$	6	$6\frac{3}{4}$	$7\frac{1}{2}$
Breadth of Single riveted Edge Laps in inches		$2\frac{1}{4}$	$2\frac{1}{2}$	3	...	...	...
* MAXIMUM SPACING FROM CENTRE TO CENTRE.							
$3\frac{1}{2}$ diam. c. to c.	In † Butts of Outside Plating, and all Beam Stringer Plates (except quadruple riveted butt laps)	$2\frac{1}{4}$	$2\frac{5}{8}$	$3\frac{1}{8}$	$3\frac{1}{2}$	4	$4\frac{3}{8}$
4 diam. c. to c.	In Edges of Outside Plating (forward and aft) Quadruple Riveted Butt Laps and Double Butt Straps; Butts of Deck Plating, Butts of Margin Plates, Girders, Tie Plates, and Floor Plates; also Butts and Edges of Inner Bottom Plating ...	$2\frac{1}{2}$	3	$3\frac{1}{2}$	4	$4\frac{1}{2}$	5
$4\frac{1}{2}$ diam. c. to c.	In Gunwale Angle Bars, Margin Plate Angles, Quintuple Riveted Butt Laps, Edges and Butts of Bulkhead Plating, Angles connecting Side Stringers to Web Frames and Edges of Deck Plating. W.T. Bulkhead Frames except Shell Flange ...	$2\frac{3}{4}$	$3\frac{3}{8}$	4	$4\frac{1}{2}$	...	...
5 diam. c. to c.	In Flat Keel Angles, Vertical Angles connecting Floors and Centre Girder, Shell Flange of W.T. Bulkhead Frames, Butts and Edges of Mast Plates, Floors and cross ties in after peak	$3\frac{1}{8}$	$3\frac{3}{4}$	$4\frac{3}{8}$	5	$5\frac{5}{8}$	$6\frac{1}{4}$
6 diam. c. to c.	In Deck Plating to Beams where single flange beams are fitted at alternate frames	$3\frac{3}{4}$	$4\frac{1}{2}$	$5\frac{1}{4}$	...	...	...
7 diam. c. to c.	In *Frames, Reversed Frames, Floors, Keelsons, Beam Angles, Deck and Hold Stringer Angles, Face Angles on Web Frames and Side Stringers, Bulkhead Stiffeners, Longitudinal Angles on continuous Girders. Vertical Angles connecting Floors and Side Girders, and Deck Plating to beams except where single flange beams are fitted at alternate frames...	$4\frac{1}{2}$	$5\frac{1}{4}$	$6\frac{1}{4}$	7	...	...

Thickness of Plates.	THICKNESS OF BUTT STRAPS. Single.	Double. Strap which is Countersunk for Rivets.	Double. Strap on opposite side of Plate.
inches.	inches.	inches.	inches.
·22	·22		
·24	·24		
·26	·26		
·28	·28		
·30	·30		
·32	·34		
·34	·38		
·36	·40		
·38	·44		
·40	·48		
·42	·52		
·44	·54	·34	·28
·46	·58	·36	„
·48	·60	·38	·30
·50	·62	·40	„
·52	·64	„	·32
·54	·68	·42	„
·56	·70	„	·34
·58	·74	·44	„
·60	·76	„	·36
·62	·78	·46	„
·64	·80	„	·38
·66	·82	·48	·40
·68	·86	„	·42
·70	·88	·50	„

Thickness of Plates.	THICKNESS OF BUTT STRAPS. Single.	Double. Strap which is Countersunk for Rivets.	Double. Strap on opposite side of Plate.
inches.	inches.	inches.	inches.
·72	·90	·52	·44
·74	·94	·54	„
·76	·96	·56	·46
·78	·98	·58	·48
·80	1·00	„	·50
·82	1·04	·60	„
·84	1·06	„	·52
·86	1·08	·62	„
·88	1·10	„	·54
·90	1·12	·64	·56
·92	1·16	„	·58
·94	1·18	·66	·60
·96	1·20	„	·62
·98	1·22	·68	„
1·00	1·24	„	·64
1·02	1·28	·70	„
1·04	1·30	„	·66
1·06	1·32	·72	„
1·08	1·34	„	·68
1·10	1·38	·74	„
1·12	1·40	„	·70
1·14	1·44	·76	„
1·16	1·46	„	·72
1·18	1·48	·78	„
1·20	1·50	„	·74

† In butts connected by single butt straps alternate rivets may be omitted in the back row of treble riveting when the longitudinal number is 16,000 and under; when above this number, the rivets in the back row are not to be more than 5 to $5\frac{1}{2}$ diameters apart from centre to centre. All overlapped butts are to have complete rows of rivets.

* The rivets attaching the outside plating to the frames are to be spaced not more than 6 diameters apart from centre to centre where the depth of framing is above 11 inches, and throughout the vessel where the rule frame spacing is above 26 inches. Where the framing consists of channel bars with reversed frames the rivets attaching the outside plating to the frames are to be spaced not more than $5\frac{1}{2}$ diameters apart from centre to centre.

Where the framing is in accordance with the requirements of Table 2, the rivets attaching the reversed frames to the frames are to be spaced the same as the rivets through the frames and outside plating.

In deep water ballast tanks and in fore and after peak tanks, the rivets through the frames and outside plating are to be spaced not more than $5\frac{1}{2}$ diameters apart from centre to centre.

The rivets in the plating and frames in the bottom of steamers, forward of the three-fifths length, are to be spaced not more than $5\frac{1}{2}$ diameters apart from centre to centre.

Rivets to be $\frac{1}{4}$ of an inch larger in diameter in the Stem, Stern Frame, and Keel, but in no case need these exceed $1\frac{1}{2}$ inches in diameter, and to be spaced 5 diameters apart from centre to centre. In single screw steamers above 350 feet in length, the after lengths of shell plating are to be connected to the portion of the stern frame below the boss with three rows of rivets.

For diameter and spacing of rivets in Rudders, *see* Table 24.

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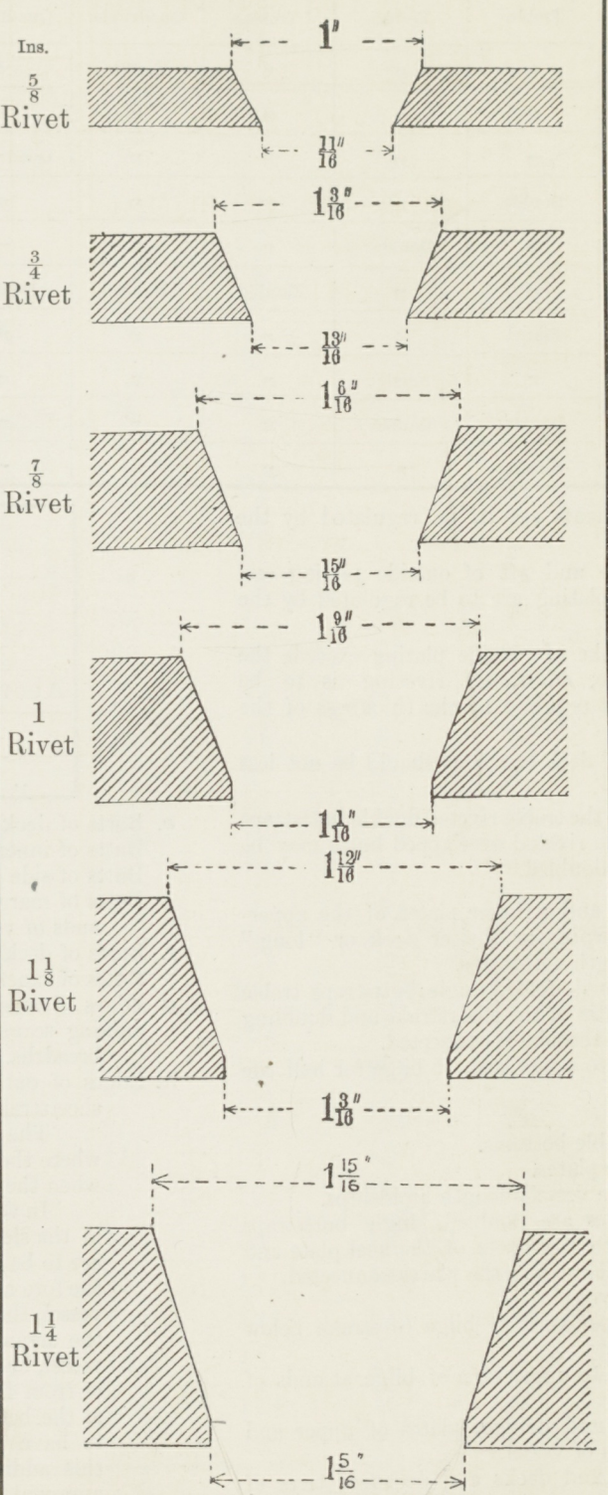
TABLE 20.

NUMBER of RIVETS IN EDGES of Plating between Frames Amidships, excluding Rivets in Frames.

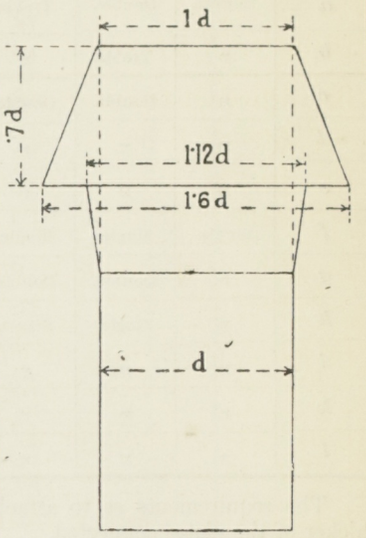
Thickness of PLATES	NUMBER OF RIVETS IN EACH ROW.					
	ins. ·22 and not exceeding ·34	ins. Above ·34 and not exceeding ·48	ins. Above ·48 and not exceeding ·66	ins. Above ·66 and not exceeding ·88	ins. Above ·88 and not exceeding 1·14	ins. Above 1·14 to 1·20
Diameter of RIVETS	$\frac{5}{8}$	$\frac{3}{4}$	$\frac{7}{8}$	1	$1\frac{1}{8}$	$1\frac{1}{4}$
Spacing of FRAMES 20 ins.	7	5	...	...	...	...
„ „ „ $20\frac{1}{2}$ „	7	6	...	...	...	...
„ „ „ 21 „	7	6	5	...	...	...
„ „ „ $21\frac{1}{2}$ „	...	6	5	...	...	...
„ „ „ 22 „	...	6	5	...	...	...
„ „ „ $22\frac{1}{2}$ „	...	6	5	...	...	...
„ „ „ 23 „	...	6	5	5	...	...
„ „ „ $23\frac{1}{2}$ „	...	7	6	5	...	...
„ „ „ 24 „	...	7	6	5	...	...
„ „ „ $24\frac{1}{2}$ „	...	...	6	5	...	...
„ „ „ 25 „	...	...	6	5	...	...
„ „ „ $25\frac{1}{2}$ „	...	...	7	6	...	...
„ „ „ 26 „	...	...	7	6	5	...
„ „ „ $26\frac{1}{2}$ „	...	...	7	6	5	...
„ „ „ 27 „	...	...	7	6	5	...
„ „ „ $27\frac{1}{2}$ „	...	...	7	6	6	...
„ „ „ 28 „	...	...	7	6	6	5
„ „ „ $28\frac{1}{2}$ „	...	...	8	7	6	5
„ „ „ 29 „	...	...	8	7	6	5
„ „ „ $29\frac{1}{2}$ „	...	...	8	7	6	5
„ „ „ 30 „	...	...	8	7	6	5
„ „ „ $30\frac{1}{2}$ „	...	...	...	7	6	6
„ „ „ 31 „	...	...	...	7	6	6
„ „ „ $31\frac{1}{2}$ „	...	...	...	8	7	6
„ „ „ 32 „	...	...	...	8	7	6
„ „ „ $32\frac{1}{2}$ „	...	...	...	8	7	6
„ „ „ 33 „	...	...	...	8	7	6

SIZE OF COUNTERSINK FOR RIVETS IN OUTSIDE PLATING.



The countersink is to extend through the whole thickness of the plate when not more than ·60 of an inch in thickness; when ·60 of an inch or above, the countersink is to extend through nine-tenths the thickness of the plate.

FORM OF RIVET TO BE USED IN OUTSIDE PLATING.



The tapered neck of Rivet to be of suitable length in relation to the thickness of plate in which it is intended to be used.

In single riveted seams one frame rivet is to be fitted through the landing edges at each frame. In double riveted seams one frame rivet is to be fitted through the landing edges at each frame, except where the frames or the edges of the outside plating are joggled when two rivets are to be fitted. In treble riveted seams two frame rivets (the upper and lower) are to be fitted through the landing edges at each frame.

Where the fore and aft flange of the frame does not exceed 3 inches, the rivets attaching the outside plating thereto should not exceed $\frac{7}{8}$ inch in diameter, and where it is $3\frac{1}{2}$ inches wide, they should not exceed 1 inch in diameter.

There are to be at least four rivets in each flange of the angle bars between the frames, which connect the stringer plates and intercostal plates to the outside plating, where the frames are spaced not more than 26 inches apart; where the spacing is above 26 inches and does not exceed 30 inches there are to be five rivets in each flange; and where the spacing is above 30 inches and not more than 33 inches there are to be six rivets in each flange.

The rivets in the beam knees are to be in number and size as required by Section 20, paragraph 15.

The rivets in the vertical angles connecting floors and outside brackets to margin plates are to be in number and size as required by Table 9.

The rivets in the connecting straps for web frames and side stringers are to be in number and size as required by Table 5.

RIVETING of BUTTS and EDGES. TABLE 21.

	THICKNESS OF PLATES.											
	·22 and not exceeding ·36	Above ·36 and not exceeding ·38	Above ·38 and not exceeding ·42	Above ·42 and not exceeding ·48	Above ·48 and not exceeding ·54	Above ·54 and not exceeding ·60	Above ·60 and not exceeding ·68	Above ·68 and not exceeding ·76	Above ·76 and not exceeding ·84	Above ·84 and not exceeding ·94	Above ·94 and not exceeding 1·04	Above 1·04 and not exceeding 1·20
a	Double.	Double.	Treble.	Treble.	Treble.	Treble.	Quadruple.	Quadruple.	Quadruple.	Double straps treble riveted.	Double straps treble riveted.	Double straps treble riveted.
b	,,	Treble.	,,	,,	,,	,,	Treble.	,,	,,	Quadruple.	Quadruple.	,,
c	,,	Double.	Double.	,,	,,	,,	,,	Treble.	,,	,,	,,	Quadruple.
d	,,	,,	,,	,,	,,	,,	,,	Quadruple.	,,	,,	,,	
e	,,	,,	,,	Double.	,,	,,	,,	,,	,,	,,	,,	
f	Single.	Single.	Single.	,,	Double.	,,	,,	,,	,,			
g	,,	Double.	Double.	,,	,,	Double.	Double.	Double.	Double.	Double.	Double.	
h	,,	Single.	Single.	Single.	,,	,,	,,	,,	,,	Treble.	Treble.	
i	,,	,,	,,	,,	Single.	,,	,,	,,	,,			
k	,,	,,	,,	Double.	Double.	,,	,,	,,	,,			
l	,,	,,	,,	Single.	,,	,,	,,	,,				

The requirements as to attachments are to be regulated by the thicker of the plates connected.

The edge attachments all fore and aft of outside plating and middle line strake of inner bottom plating are to be regulated by the thickness of the plating amidships.

Where the breadth of any strake of outside plating exceeds the limits given in the following Table, additional riveting is to be provided at the butts in excess of that required by the thickness of the plates.

Butts of side plating of "short" deck erections should be not less than double riveted.

As an alternative arrangement to the treble riveted double buttstraps required by the above Table, quintuple riveted overlapped butts may be adopted, except for strakes which are doubled.

a. Butts of sheerstrake, strake below and stringer plates, of the uppermost deck, whether upper, awning or shelter deck or "long" bridge, for half the vessel's length amidships.

Where the sheerstrake is doubled, single buttstraps treble riveted are to be fitted to the butts of the sheerstrake and doubling plate, of the same thickness as the plates connected.

Butts of outside plating from keel to upper turn of bilge for half the vessel's length amidships.

Butts of boss plates.

Butts of centre girder plates in double bottoms.

Butts of floor plates and web frame plates.

b. Butts of flat keel plates for half the vessel's length amidships.

Where the flat keel plates are doubled, single buttstraps treble riveted are to be fitted to the butts of the keel plate and doubling plate, of the same thickness as the plates connected.

c. Butts of flat keel plates at ends of vessel.

d. Butts of outside plating from upper turn of bilge to strake below sheerstrake.

Butts of outside plating from keel to upper turn of bilge at ends of vessel.

Butts of sheerstrake, strake below and stringer plates of upper and awning or shelter decks at ends of vessel.

Butts of beam stringer plates of 2nd decks and decks or tiers of beams below.

Butts of tie plates.

Butts of margin plates and middle line strake of double bottoms for half the vessel's length amidships.

Butts of vertical keelson plates, rider plates, and foundation plates.

DEPTH (D) OF VESSEL.	MAXIMUM BREADTH OF STRAKE FOR RULE RIVETING.
Feet.	Inches.
Not exceeding 20	54
Above 20 and ,, ,, 24	60
,, 24 ,, ,, ,, 28	66
,, 28	72

e. Butts of deck plates for half the vessel's length amidships.

Butts of inner bottom plating for half the vessel's length amidships.

Butts of side girders in double bottoms.

Butts of margin plates and middle line strake of double bottoms at ends of vessel.

f. Butts of deck plates at ends of vessel.

Butts of inner bottom plating at ends of double bottoms.

g. Edges of outside plating from keel to upper turn of bilge.

Joining seams of stringer plates where the stringer is fitted in two breadths.

h. Edges of outside plating from upper turn of bilge to strake below sheerstrake.

The edges of sheerstrakes are to be double riveted except where the thickness of the side plating is above ·84 of an inch, when they are to be treble riveted.

In vessels exceeding 480 feet in length and where the thickness of the side plating is not more than ·84 inch, the landing edges are to be treble riveted for one-fourth of the vessel's length in the fore and after bodies for a depth of one-third the depth of the vessel, the actual position of this treble riveting to depend upon the arrangement of shell plating and the special design of the vessel, or other equivalent strengthening to be afforded. Vessels of from 450 feet to 480 feet in length are to be additionally riveted at the before mentioned parts proportionately to their length, or to have other equivalent strengthening. Each case requiring this additional riveting of the seams is to be submitted for the approval of the Committee. Where the thickness of the side plating is above ·84 inch, the edges are to be treble riveted for four-fifths of the vessel's length amidships.

i. Edges of deck plates.

k. Edges of middle line strake of inner bottom plating.

l. Edges of inner bottom plating except middle line strake.

DIAMETERS OF RUDDER HEADS. TABLE 22.

A × D*	SPEED OF VESSEL IN KNOTS PER HOUR. **						
	Not exceeding 10	Above 10 and not exceeding 12	Above 12 and not exceeding 14	Above 14 and not exceeding 16	Above 16 and not exceeding 18	Above 18 and not exceeding 20	Above 20 and not exceeding 22
	DIAMETER OF RUDDER HEAD IN INCHES.						
Above 22 and not exceeding 28	2¾	3	3¼	3½	4	4½	5
28 „ 34	3	3¼	3½	3¾	4¼	4¾	5¼
34 „ 40	3¼	3½	3¾	4	4½	5	5½
40 „ 47	3½	3¾	4	4½	5	5½	6
47 „ 55	3¾	4	4¼	4¾	5¼	5¾	6¼
55 „ 64	4	4¼	4½	5	5½	6	6½
64 „ 73	4¼	4½	4¾	5¼	5¾	6¼	6¾
73 „ 83	4½	4¾	5	5½	6	6½	7
83 „ 94	4¾	5	5½	6	6½	7	7½
94 „ 105	5	5¼	5¾	6¼	6¾	7¼	7¾
105 „ 117	5¼	5½	6	6½	7	7½	8
117 „ 130	5½	5¾	6¼	6¾	7¼	7¾	8¼
130 „ 144	5¾	6	6½	7	7½	8	8½
144 „ 160	6	6¼	6¾	7¼	7¾	8¼	9
160 „ 176	6¼	6½	7	7½	8	8½	9¼
176 „ 192	6½	6¾	7¼	7¾	8¼	8¾	9½
192 „ 209	6¾	7	7½	8	8½	9¼	10
209 „ 227	7	7¼	7¾	8¼	8¾	9½	10¼
227 „ 246	7¼	7½	8	8½	9	9¾	10½
246 „ 268	7½	7¾	8¼	8¾	9¼	10	10¾
268 „ 290	7¾	8	8½	9	9½	10¼	11
290 „ 335	8	8½	9	9½	10	10½	11½
335 „ 390	8½	9	9½	10	10½	11½	12½
390 „ 445	9	9½	10	10½	11	12	13
445 „ 505	9½	10	10½	11	12	13	14
505 „ 570	10	10½	11	11½	12½	13½	14½
570 „ 640	10½	11	11½	12½	13½	14½	15½
640 „ 720	11	11½	12	13	14	15	16
720 „ 800	11½	12	12½	13½	14½	15½	16½
800 „ 890	12	12½	13	14	15	16	17
890 „ 980	12½	13	13½	14½	15½	16½	17½
980 „ 1080	13	13½	14½	15½	16½	17½	18½
1080 „ 1180	13½	14	15	16	17	18	19
1180 „ 1290	14	14½	15½	16½	17½	18½	19½
1290 „ 1400	14½	15	16	17	18	19	20

* A is the total rudder area abaft the centre line of the pintles in square feet, and D is the distance in feet of its centre of gravity abaft the centre line of the pintles.

** The diameters of rudder heads of sailing vessels are to be as required for vessels with a speed not exceeding 10 knots per hour.

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TABLE 23.

COUPLINGS of RUDDER HEADS.

DIAMETER OF RUDDER HEAD, AS PER TABLE 22.	HORIZONTAL COUPLING. 6 BOLTS.		VERTICAL COUPLING. 8 BOLTS.		SCARPHED COUPLING. †					
					LENGTH OF SCARPH.	WIDTH OF SCARPHS.		BOLTS.		
								NUMBER.		
	Mean distance of Centres of Bolts from Centre of Coupling.	*Diameter of Bolts and Thickness of Flanges.	Width of Coupling.	**Diameter of Bolts and Thickness of Flanges.		At Top.	At Bottom.	Total.	In Top Row.	Diameter. **
inches.	inches.	inches.	inches.	inches.	inches.	inches.	inches.			inches.
6	$5\frac{1}{2}$	$1\frac{1}{2}$	$13\frac{1}{2}$	$1\frac{1}{2}$	15	$10\frac{1}{2}$	$16\frac{1}{2}$	6	2	$1\frac{7}{8}$
$6\frac{1}{4}$	$5\frac{3}{4}$	$1\frac{5}{8}$	14	$1\frac{5}{8}$	$15\frac{3}{4}$	11	$17\frac{1}{4}$	6	2	2
$6\frac{1}{2}$	6	$1\frac{3}{4}$	$14\frac{1}{2}$	$1\frac{3}{4}$	$16\frac{1}{4}$	$11\frac{1}{2}$	18	6	2	$2\frac{1}{8}$
$6\frac{3}{4}$	$6\frac{1}{4}$	$1\frac{3}{4}$	15	$1\frac{3}{4}$	17	12	$18\frac{3}{4}$	6	2	$2\frac{1}{8}$
7	$6\frac{1}{2}$	$1\frac{7}{8}$	$15\frac{3}{4}$	$1\frac{7}{8}$	$17\frac{1}{2}$	$12\frac{1}{4}$	$19\frac{1}{2}$	6	2	$2\frac{1}{4}$
$7\frac{1}{4}$	$6\frac{3}{4}$	2	$16\frac{1}{4}$	2	18	$12\frac{3}{4}$	20	6	2	$2\frac{1}{4}$
$7\frac{1}{2}$	7	2	$16\frac{3}{4}$	2	$18\frac{3}{4}$	$13\frac{1}{4}$	21	7	2	$2\frac{1}{8}$
$7\frac{3}{4}$	$7\frac{1}{4}$	$2\frac{1}{8}$	$17\frac{1}{2}$	$2\frac{1}{8}$	$19\frac{1}{2}$	$13\frac{1}{2}$	$21\frac{1}{2}$	7	2	$2\frac{1}{8}$
8	$7\frac{1}{2}$	$2\frac{1}{4}$	18	$2\frac{1}{4}$	20	14	22	7	2	$2\frac{1}{4}$
$8\frac{1}{2}$	$7\frac{3}{4}$	$2\frac{3}{8}$	19	$2\frac{3}{8}$	$21\frac{1}{4}$	15	24	7	2	$2\frac{1}{2}$
9	$8\frac{1}{4}$	$2\frac{1}{2}$	20	$2\frac{1}{2}$	$22\frac{1}{2}$	$15\frac{3}{4}$	25	7	2	$2\frac{5}{8}$
$9\frac{1}{2}$	$8\frac{1}{2}$	$2\frac{5}{8}$	$21\frac{1}{2}$	$2\frac{5}{8}$	$23\frac{3}{4}$	$16\frac{3}{4}$	26	7	2	$2\frac{3}{4}$
10	9	$2\frac{3}{4}$	$22\frac{1}{2}$	$2\frac{3}{4}$	25	$17\frac{1}{2}$	28	7	2	$2\frac{7}{8}$
$10\frac{1}{2}$	$9\frac{1}{2}$	$2\frac{7}{8}$	$23\frac{1}{2}$	$2\frac{7}{8}$	$26\frac{1}{4}$	$18\frac{1}{2}$	29	8	2	$2\frac{7}{8}$
11	10	3	$24\frac{3}{4}$	3	$27\frac{1}{2}$	$19\frac{1}{4}$	30	8	2	3
$11\frac{1}{2}$	$10\frac{1}{2}$	$3\frac{1}{8}$	26	$3\frac{1}{8}$	$28\frac{3}{4}$	$20\frac{1}{4}$	32	8	2	$3\frac{1}{8}$
12	$10\frac{3}{4}$	$3\frac{1}{4}$	27	$3\frac{1}{4}$	30	21	33	8	2	$3\frac{1}{4}$
$12\frac{1}{2}$	$11\frac{1}{4}$	$3\frac{3}{8}$	28	$3\frac{3}{8}$	$31\frac{1}{4}$	25	$34\frac{1}{2}$	9	3	$3\frac{1}{4}$
13	$11\frac{3}{4}$	$3\frac{1}{2}$	29	$3\frac{1}{2}$	$32\frac{1}{2}$	26	36	9	3	$3\frac{1}{4}$
$13\frac{1}{2}$	$12\frac{1}{4}$	$3\frac{5}{8}$	30	$3\frac{5}{8}$	$33\frac{3}{4}$	27	$37\frac{1}{2}$	9	3	$3\frac{3}{8}$
14	$12\frac{3}{4}$	$3\frac{3}{4}$	$31\frac{1}{2}$	$3\frac{3}{4}$	35	28	39	9	3	$3\frac{5}{8}$
$14\frac{1}{2}$	13	$3\frac{7}{8}$	$32\frac{1}{2}$	$3\frac{7}{8}$	$36\frac{1}{4}$	29	40	9	3	$3\frac{3}{4}$
15	$13\frac{1}{2}$	4	$33\frac{1}{2}$	4	$37\frac{1}{2}$	30	41	9	3	$3\frac{7}{8}$

* The diameter of bolts in horizontal couplings is to be measured at the coupling surfaces.

** The diameter of bolts in vertical and scarphed couplings is to be the minimum diameter clear of the screw threads, and the diameter at bottom of threads is not to be less than $\frac{7}{8}$ths that given in the Table.

† The thickness of the tip of the palms of scarphed couplings is to be ·13 of the diameter of the head.

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RUDDERS.

TABLE 24.

(See Continuation.)

Diameter of Rudder Head as per Table 22.	Diameter of Pintles.	DOUBLE PLATE RUDDERS. (*f*)				SINGLE PLATE RUDDERS.						
								Arm at each Pintle Keyed to Mainpiece.				
		Section of Mainpiece at Heel.	Minimum dimensions of Bow and Stays.	Thickness of Plates.	Diameter of Rivets spaced 5 diameters apart centre to centre.	Diameter of Mainpiece at Heel (if round)	Section of Mainpiece at Heel (if rectangular).	Depth and Thickness of Arm at Mainpiece.	Thickness of Arm round Mainpiece.	Depth and Thickness of Arm at Point.	Maximum Distance between Centre of Arms.	Thickness of Plate.
inches.	inches.	inches. (*a*) (*b*)	inches.	inches.	inches.	inches.	inches. (*a*) (*b*)	inches.	inches.	inches.	inches.	inches.
$2\frac{3}{4}$	$1\frac{3}{4}$	$2 \times 1\frac{3}{4}$	$2 \times \frac{7}{8}$	·24	$\frac{3}{4}$	$2\frac{1}{4}$	2×2	$2\frac{3}{4} \times 1\frac{7}{8}$	$1\frac{1}{4}$	$2\frac{1}{2} \times \frac{3}{4}$	45	·74
3	2	2×2	$2 \times \frac{7}{8}$	·24	$\frac{3}{4}$	$2\frac{1}{2}$	$2 \times 2\frac{1}{4}$	3×2	$1\frac{3}{8}$	$2\frac{1}{2} \times \frac{3}{4}$	45	·74
$3\frac{1}{4}$	2	$2\frac{1}{4} \times 2$	$2\frac{1}{4} \times \frac{7}{8}$	·24	$\frac{3}{4}$	$2\frac{3}{4}$	$2\frac{1}{4} \times 2\frac{1}{2}$	$3\frac{1}{4} \times 2\frac{1}{8}$	$1\frac{3}{8}$	$2\frac{1}{2} \times \frac{3}{4}$	46	·76
$3\frac{1}{2}$	2	$2\frac{1}{2} \times 2$	$2\frac{1}{4} \times \frac{7}{8}$	·26	$\frac{3}{4}$	$2\frac{3}{4}$	$2\frac{1}{2} \times 2\frac{3}{4}$	$3\frac{1}{2} \times 2\frac{1}{4}$	$1\frac{1}{2}$	$2\frac{3}{4} \times \frac{3}{4}$	46	·76
$3\frac{3}{4}$	$2\frac{1}{4}$	$2\frac{1}{2} \times 2\frac{1}{4}$	$2\frac{1}{2} \times \frac{7}{8}$	·26	$\frac{3}{4}$	3	$2\frac{1}{2} \times 3$	$3\frac{3}{4} \times 2\frac{3}{8}$	$1\frac{5}{8}$	$2\frac{3}{4} \times \frac{3}{4}$	47	·78
4	$2\frac{1}{4}$	$2\frac{3}{4} \times 2\frac{1}{4}$	$2\frac{1}{2} \times 1$	·26	$\frac{3}{4}$	3	$2\frac{3}{4} \times 3$	$4 \times 2\frac{1}{2}$	$1\frac{3}{4}$	$3 \times \frac{7}{8}$	48	·80
$4\frac{1}{4}$	$2\frac{1}{2}$	$2\frac{3}{4} \times 2\frac{1}{2}$	$2\frac{1}{2} \times 1$	·26	$\frac{3}{4}$	$3\frac{1}{4}$	$2\frac{3}{4} \times 3\frac{3}{8}$	$4\frac{1}{4} \times 2\frac{5}{8}$	$1\frac{7}{8}$	$3 \times \frac{7}{8}$	49	·80
$4\frac{1}{2}$	$2\frac{3}{4}$	$3 \times 2\frac{3}{4}$	$2\frac{1}{2} \times 1\frac{1}{8}$	·28	$\frac{3}{4}$	$3\frac{1}{2}$	$3 \times 3\frac{3}{4}$	$4\frac{1}{2} \times 2\frac{3}{4}$	2	$3\frac{1}{4} \times \frac{7}{8}$	50	·82
$4\frac{3}{4}$	$2\frac{3}{4}$	$3\frac{1}{4} \times 2\frac{3}{4}$	$2\frac{3}{4} \times 1\frac{1}{8}$	·28	$\frac{3}{4}$	$3\frac{1}{2}$	$3\frac{1}{4} \times 3\frac{3}{4}$	$4\frac{3}{4} \times 2\frac{7}{8}$	2	$3\frac{1}{4} \times \frac{7}{8}$	51	·84
5	3	$3\frac{1}{4} \times 3$	$2\frac{3}{4} \times 1\frac{1}{4}$	·28	$\frac{7}{8}$	$3\frac{3}{4}$	$3\frac{1}{4} \times 4$	5×3	$2\frac{1}{8}$	$3\frac{1}{2} \times 1$	52	·86
$5\frac{1}{4}$	3	$3\frac{1}{2} \times 3$	$2\frac{3}{4} \times 1\frac{1}{4}$	·28	$\frac{7}{8}$	4	$3\frac{1}{2} \times 4$	$5\frac{1}{4} \times 3\frac{1}{8}$	$2\frac{1}{4}$	$3\frac{1}{2} \times 1$	53	·88
$5\frac{1}{2}$	3	4×3	$2\frac{3}{4} \times 1\frac{3}{8}$	·30	$\frac{7}{8}$	$4\frac{1}{4}$	4×4	$5\frac{1}{2} \times 3\frac{1}{8}$	$2\frac{1}{4}$	$3\frac{3}{4} \times 1$	54	·90
$5\frac{3}{4}$	3	$4\frac{1}{4} \times 3$	$3 \times 1\frac{3}{8}$	·30	$\frac{7}{8}$	$4\frac{1}{4}$	$4\frac{1}{4} \times 4$	$5\frac{3}{4} \times 3\frac{1}{4}$	$2\frac{3}{8}$	$3\frac{3}{4} \times 1$	54	·90
6	3	$4\frac{1}{2} \times 3$	$3 \times 1\frac{1}{2}$	·30	$\frac{7}{8}$	$4\frac{1}{2}$	$4\frac{1}{2} \times 4\frac{1}{4}$	$6 \times 3\frac{3}{8}$	$2\frac{3}{8}$	4×1	55	·92
$6\frac{1}{4}$	$3\frac{1}{4}$	$4\frac{3}{4} \times 3\frac{1}{4}$	$3 \times 1\frac{1}{2}$	·30	$\frac{7}{8}$	$4\frac{3}{4}$	$4\frac{3}{4} \times 4\frac{3}{8}$	$6\frac{1}{4} \times 3\frac{3}{8}$	$2\frac{3}{8}$	$4\frac{1}{4} \times 1$	56	·94
$6\frac{1}{2}$	$3\frac{1}{4}$	$5 \times 3\frac{1}{4}$	$3 \times 1\frac{5}{8}$	·32	$\frac{7}{8}$	$4\frac{7}{8}$	$5 \times 4\frac{1}{2}$	$6\frac{1}{2} \times 3\frac{1}{2}$	$2\frac{1}{2}$	$4\frac{1}{2} \times 1$	57	·94
$6\frac{3}{4}$	$3\frac{1}{2}$	$5\frac{1}{4} \times 3\frac{1}{2}$	$3\frac{1}{4} \times 1\frac{5}{8}$	·32	$\frac{7}{8}$	5	$5\frac{1}{4} \times 4\frac{1}{2}$	$6\frac{3}{4} \times 3\frac{1}{2}$	$2\frac{1}{2}$	$4\frac{3}{4} \times 1$	58	·96
7	$3\frac{1}{2}$	$5\frac{1}{2} \times 3\frac{1}{2}$	$3\frac{1}{4} \times 1\frac{3}{4}$	·32	$\frac{7}{8}$	$5\frac{1}{4}$	$5\frac{1}{2} \times 4\frac{5}{8}$	$7 \times 3\frac{5}{8}$	$2\frac{1}{2}$	5×1	59	·98
$7\frac{1}{4}$	$3\frac{1}{2}$	$6 \times 3\frac{1}{2}$	$3\frac{1}{2} \times 1\frac{3}{4}$	·34	$\frac{7}{8}$	$5\frac{1}{2}$	$6 \times 4\frac{5}{8}$	$7\frac{1}{4} \times 3\frac{5}{8}$	$2\frac{5}{8}$	$5\frac{1}{4} \times 1$	60	1·00
$7\frac{1}{2}$	$3\frac{3}{4}$	$6\frac{1}{4} \times 3\frac{3}{4}$	$3\frac{1}{2} \times 1\frac{7}{8}$	·34	$\frac{7}{8}$	$5\frac{1}{2}$	$6\frac{1}{4} \times 4\frac{3}{4}$	$7\frac{1}{2} \times 3\frac{3}{4}$	$2\frac{5}{8}$	$5\frac{1}{2} \times 1$	61	1·00
$7\frac{3}{4}$	$3\frac{3}{4}$	$6\frac{1}{2} \times 3\frac{3}{4}$	$3\frac{3}{4} \times 1\frac{7}{8}$	·34	$\frac{7}{8}$	$5\frac{3}{4}$	$6\frac{1}{2} \times 5$	$7\frac{3}{4} \times 3\frac{7}{8}$	$2\frac{3}{4}$	$5\frac{3}{4} \times 1$	61	1·00
8	4	$6\frac{1}{2} \times 4$	$3\frac{3}{4} \times 2$	·36	1	6	$6\frac{1}{2} \times 5\frac{3}{8}$	8×4	$2\frac{3}{4}$	6×1	62	1·02
$8\frac{1}{2}$	$4\frac{1}{4}$	$6\frac{3}{4} \times 4\frac{1}{4}$	4×2	·36	1	$6\frac{1}{2}$	$6\frac{3}{4} \times 5\frac{5}{8}$	$8\frac{1}{2} \times 4\frac{1}{4}$	3	$6\frac{1}{4} \times 1\frac{1}{8}$	63	1·04
9	$4\frac{1}{2}$	$7 \times 4\frac{1}{2}$	$4 \times 2\frac{1}{8}$	·38	1	$6\frac{3}{4}$	7×6	$9 \times 4\frac{3}{8}$	3	$6\frac{1}{2} \times 1\frac{1}{8}$	63	1·04
$9\frac{1}{2}$	$4\frac{3}{4}$	$7\frac{1}{2} \times 4\frac{3}{4}$	$4\frac{1}{4} \times 2\frac{1}{8}$	·38	1	$7\frac{1}{4}$	$7\frac{1}{2} \times 6\frac{3}{8}$	$9\frac{1}{2} \times 4\frac{1}{2}$	$3\frac{1}{8}$	$6\frac{3}{4} \times 1\frac{1}{8}$	64	1·06
10	5	8×5	$4\frac{1}{4} \times 2\frac{1}{4}$	·40	1	$7\frac{1}{2}$	$8 \times 6\frac{5}{8}$	$10 \times 4\frac{5}{8}$	$3\frac{1}{4}$	$7 \times 1\frac{1}{8}$	65	1·08
$10\frac{1}{2}$	$5\frac{1}{4}$	$8\frac{1}{4} \times 5\frac{1}{4}$	$4\frac{1}{2} \times 2\frac{1}{4}$	·40	1	8	$8\frac{1}{4} \times 7$	$10\frac{1}{2} \times 4\frac{3}{4}$	$3\frac{3}{8}$	$7\frac{1}{4} \times 1\frac{1}{8}$	66	1·10
11	$5\frac{1}{2}$	$8\frac{1}{2} \times 5\frac{1}{2}$	$4\frac{1}{2} \times 2\frac{3}{8}$	·42	1	$8\frac{1}{4}$	$8\frac{1}{2} \times 7\frac{1}{4}$	11×5	$3\frac{1}{2}$	$7\frac{1}{2} \times 1\frac{1}{8}$	67	1·10
$11\frac{1}{2}$	$5\frac{3}{4}$	$8\frac{3}{4} \times 5\frac{3}{4}$	$4\frac{3}{4} \times 2\frac{3}{8}$	·42	1	$8\frac{1}{2}$	$8\frac{3}{4} \times 7\frac{1}{2}$	$11\frac{1}{2} \times 5\frac{1}{4}$	$3\frac{5}{8}$	$7\frac{1}{2} \times 1\frac{1}{8}$	68	1·12
12	6	9×6	$4\frac{3}{4} \times 2\frac{3}{8}$	·44	1	9	$9\frac{1}{4} \times 7\frac{3}{4}$	$12 \times 5\frac{3}{8}$	$3\frac{5}{8}$	$7\frac{3}{4} \times 1\frac{1}{8}$	69	1·12
$12\frac{1}{2}$	$6\frac{1}{4}$	$9\frac{1}{2} \times 6\frac{1}{4}$	$5 \times 2\frac{3}{8}$	·46	$1\frac{1}{8}$	$9\frac{1}{2}$	$9\frac{3}{8} \times 8$	$12\frac{1}{2} \times 5\frac{1}{2}$	$3\frac{3}{4}$	$7\frac{3}{4} \times 1\frac{1}{8}$	70	1·14
13	$6\frac{1}{2}$	$10 \times 6\frac{1}{4}$	$5 \times 2\frac{1}{2}$	·48	$1\frac{1}{8}$	$9\frac{3}{4}$	$10 \times 8\frac{1}{2}$	$13 \times 5\frac{1}{2}$	$3\frac{3}{4}$	$8 \times 1\frac{1}{8}$	71	1·14
$13\frac{1}{2}$	$6\frac{3}{4}$	$10\frac{1}{2} \times 6\frac{1}{2}$	$5 \times 2\frac{5}{8}$	·50	$1\frac{1}{8}$	$10\frac{1}{4}$	$10\frac{1}{2} \times 8\frac{3}{4}$	$13\frac{1}{2} \times 5\frac{5}{8}$	$3\frac{7}{8}$	$8 \times 1\frac{1}{8}$	·72	1·16
14	$6\frac{3}{4}$	$11 \times 6\frac{1}{2}$	$5 \times 2\frac{5}{8}$	·50	$1\frac{1}{8}$	$10\frac{1}{2}$	$10\frac{3}{4} \times 9\frac{1}{4}$	$14 \times 5\frac{5}{8}$	$3\frac{7}{8}$	$8\frac{1}{4} \times 1\frac{1}{8}$	73	1·16
$14\frac{1}{2}$	7	$11\frac{1}{4} \times 6\frac{3}{4}$	$5 \times 2\frac{5}{8}$	·50	$1\frac{1}{8}$	11	$11\frac{1}{4} \times 9\frac{1}{2}$	$14\frac{1}{2} \times 5\frac{3}{4}$	4	$8\frac{1}{4} \times 1\frac{1}{8}$	74	1·18
15	7	$11\frac{1}{2} \times 6\frac{3}{4}$	$5 \times 2\frac{5}{8}$	·50	$1\frac{1}{8}$	$11\frac{1}{4}$	$11\frac{1}{2} \times 10$	$15 \times 5\frac{3}{4}$	4	$8\frac{1}{2} \times 1\frac{1}{8}$	75	1·18

RUDDERS.

TABLE 24.
(Concluded.)

Diameter of Rudder Head as per Table 22.	Diameter of Pintles.	SINGLE PLATE RUDDERS.							
		Arms at and between Rudder Pintles.							Diameter of Rivets spaced $4\frac{1}{2}$ diameters apart centre to centre. (e)
		Keyed to Mainpiece.		Forged to Mainpiece.		Depth and Thickness of Arms at Point.	Maximum distance between Centre of Arms.	Thickness of Plate.	
		Depth and Thickness of Arms at Mainpiece.	Thickness of Arm round Mainpiece.	Depth of Arms.					
				With Small Fillet.	With Large Fillet.				
inches.	inches.	inches.	inches.	inches. (c)	inches. (d)	inches.	inches.	inches.	inches.
$2\frac{3}{4}$	$1\frac{3}{4}$	$2\frac{3}{4}\times1\frac{1}{2}$	$1\frac{1}{8}$	5	$4\frac{1}{2}$	$2\frac{1}{2}\times\frac{3}{4}$	26	·50	1
3	2	$3\times1\frac{1}{2}$	$1\frac{1}{8}$	5	$4\frac{1}{2}$	$2\frac{1}{2}\times\frac{3}{4}$	26	·50	1
$3\frac{1}{4}$	2	$3\frac{1}{4}\times1\frac{1}{2}$	$1\frac{1}{8}$	5	$4\frac{1}{2}$	$2\frac{1}{2}\times\frac{3}{4}$	26	·50	1
$3\frac{1}{2}$	2	$3\frac{1}{2}\times1\frac{5}{8}$	$1\frac{1}{8}$	5	$4\frac{1}{2}$	$2\frac{1}{2}\times\frac{3}{4}$	26	·52	1
$3\frac{3}{4}$	$2\frac{1}{4}$	$3\frac{3}{4}\times1\frac{3}{4}$	$1\frac{1}{4}$	5	$4\frac{1}{2}$	$2\frac{1}{2}\times\frac{3}{4}$	26	·52	1
4	$2\frac{1}{4}$	$4\times1\frac{7}{8}$	$1\frac{3}{8}$	$5\frac{1}{2}$	$4\frac{1}{2}$	$2\frac{3}{4}\times\frac{7}{8}$	27	·54	1
$4\frac{1}{4}$	$2\frac{1}{2}$	$4\frac{1}{4}\times1\frac{7}{8}$	$1\frac{3}{8}$	$5\frac{1}{2}$	$4\frac{1}{2}$	$2\frac{3}{4}\times\frac{7}{8}$	27	·54	1
$4\frac{1}{2}$	$2\frac{3}{4}$	$4\frac{1}{2}\times2$	$1\frac{3}{8}$	$5\frac{1}{2}$	$4\frac{1}{2}$	$2\frac{3}{4}\times\frac{7}{8}$	27	·56	1
$4\frac{3}{4}$	$2\frac{3}{4}$	$4\frac{3}{4}\times2\frac{1}{8}$	$1\frac{1}{2}$	$5\frac{1}{2}$	$4\frac{1}{2}$	$2\frac{3}{4}\times\frac{7}{8}$	27	·56	1
5	3	$5\times2\frac{1}{8}$	$1\frac{1}{2}$	$5\frac{1}{2}$	$4\frac{1}{2}$	3×1	28	·58	$1\frac{1}{8}$
$5\frac{1}{4}$	3	$5\times2\frac{1}{4}$	$1\frac{1}{2}$	$5\frac{1}{2}$	$4\frac{1}{2}$	3×1	28	·58	$1\frac{1}{8}$
$5\frac{1}{2}$	3	$5\frac{1}{4}\times2\frac{1}{4}$	$1\frac{1}{2}$	6	5	3×1	28	·60	$1\frac{1}{8}$
$5\frac{3}{4}$	3	$5\frac{1}{2}\times2\frac{3}{8}$	$1\frac{5}{8}$	6	5	3×1	28	·60	$1\frac{1}{8}$
6	3	$5\frac{1}{2}\times2\frac{3}{8}$	$1\frac{5}{8}$	6	5	$3\frac{1}{4}\times1$	29	·62	$1\frac{1}{8}$
$6\frac{1}{4}$	$3\frac{1}{4}$	$5\frac{3}{4}\times2\frac{3}{8}$	$1\frac{5}{8}$	6	5	$3\frac{1}{2}\times1$	29	·64	$1\frac{1}{8}$
$6\frac{1}{2}$	$3\frac{1}{4}$	$5\frac{3}{4}\times2\frac{1}{2}$	$1\frac{3}{4}$	6	5	$3\frac{3}{4}\times1$	29	·66	$1\frac{1}{8}$
$6\frac{3}{4}$	$3\frac{1}{2}$	$6\times2\frac{5}{8}$	$1\frac{7}{8}$	6	5	$3\frac{3}{4}\times1$	29	·66	$1\frac{1}{8}$
7	$3\frac{1}{2}$	$6\times2\frac{3}{4}$	2	6	5	4×1	30	·68	$1\frac{1}{8}$
$7\frac{1}{4}$	$3\frac{1}{2}$	$6\times2\frac{3}{4}$	2	6	5	4×1	30	·68	$1\frac{1}{8}$
$7\frac{1}{2}$	$3\frac{3}{4}$	$6\times2\frac{7}{8}$	$2\frac{1}{8}$	6	5	$4\frac{1}{4}\times1$	30	·70	$1\frac{1}{8}$
$7\frac{3}{4}$	$3\frac{3}{4}$	$6\frac{1}{4}\times3$	$2\frac{1}{8}$	6	5	$4\frac{1}{4}\times1$	30	·70	$1\frac{1}{8}$
8	4	$6\frac{1}{4}\times3\frac{1}{8}$	$2\frac{1}{4}$	6	5	$4\frac{1}{2}\times1$	31	·72	$1\frac{1}{4}$
$8\frac{1}{2}$	$4\frac{1}{4}$	$6\frac{1}{4}\times3\frac{1}{4}$	$2\frac{1}{4}$	$6\frac{1}{2}$	$5\frac{1}{2}$	$4\frac{1}{2}\times1\frac{1}{8}$	31	·72	$1\frac{1}{4}$
9	$4\frac{1}{2}$	$6\frac{1}{4}\times3\frac{1}{2}$	$2\frac{1}{2}$	$6\frac{1}{2}$	$5\frac{1}{2}$	$4\frac{1}{2}\times1\frac{1}{8}$	32	·74	$1\frac{1}{4}$
$9\frac{1}{2}$	$4\frac{3}{4}$	$6\frac{1}{2}\times3\frac{7}{8}$	$2\frac{3}{4}$	$6\frac{1}{2}$	$5\frac{1}{2}$	$4\frac{1}{2}\times1\frac{1}{8}$	32	·76	$1\frac{1}{4}$
10	5	$6\frac{1}{2}\times4\frac{1}{8}$	$2\frac{7}{8}$	$6\frac{1}{2}$	$5\frac{1}{2}$	$4\frac{3}{4}\times1\frac{1}{8}$	33	·78	$1\frac{1}{4}$
$10\frac{1}{2}$	$5\frac{1}{4}$	$6\frac{1}{2}\times4\frac{1}{4}$	3	$6\frac{1}{2}$	$5\frac{1}{2}$	$4\frac{3}{4}\times1\frac{1}{8}$	33	·80	$1\frac{1}{4}$
11	$5\frac{1}{2}$	$6\frac{3}{4}\times4\frac{3}{8}$	$3\frac{1}{8}$	7	6	$4\frac{3}{4}\times1\frac{1}{8}$	34	·82	$1\frac{1}{4}$
$11\frac{1}{2}$	$5\frac{3}{4}$	$6\frac{3}{4}\times4\frac{1}{2}$	$3\frac{1}{4}$	7	6	$4\frac{3}{4}\times1\frac{1}{8}$	34	·82	$1\frac{1}{4}$
12	6	$7\times4\frac{5}{8}$	$3\frac{3}{8}$	7	6	$5\times1\frac{1}{8}$	35	·84	$1\frac{1}{4}$
$12\frac{1}{2}$	$6\frac{1}{4}$	$7\frac{1}{4}\times4\frac{3}{4}$	$3\frac{1}{2}$	7	6	$5\times1\frac{1}{8}$	35	·84	$1\frac{1}{4}$
13	$6\frac{1}{2}$	$7\frac{1}{2}\times4\frac{7}{8}$	$3\frac{1}{2}$	7	6	$5\times1\frac{1}{8}$	36	·86	$1\frac{1}{4}$
$13\frac{1}{2}$	$6\frac{3}{4}$	$7\frac{3}{4}\times5$	$3\frac{5}{8}$	$7\frac{1}{2}$	$6\frac{1}{2}$	$5\times1\frac{1}{8}$	36	·86	$1\frac{1}{4}$
14	$6\frac{3}{4}$	$8\times5\frac{1}{8}$	$3\frac{5}{8}$	$7\frac{1}{2}$	$6\frac{1}{2}$	$5\frac{1}{4}\times1\frac{1}{8}$	37	·88	$1\frac{1}{4}$
$14\frac{1}{2}$	7	$8\frac{1}{4}\times5\frac{1}{4}$	$3\frac{3}{4}$	$7\frac{1}{2}$	$6\frac{1}{2}$	$5\frac{1}{4}\times1\frac{1}{8}$	37	·88	$1\frac{1}{4}$
15	7	$8\frac{1}{2}\times5\frac{3}{8}$	$3\frac{3}{4}$	$7\frac{1}{2}$	$6\frac{1}{2}$	$5\frac{1}{4}\times1\frac{1}{8}$	38	·90	$1\frac{1}{4}$

(*a*) The figures in this column to be the fore and aft dimensions.

(*b*) The figures in this column to be the athwartship dimensions.

(*c*) Fillets to arms forged or cast on the mainpiece not to have a less radius than one-fifth of the distance between the arms.

(*d*) Radius of fillets to be equal to half the distance between the arms.

(*e*) Where the width of arms exceeds four and a half inches reeled riveting is to be adopted.

(*f*) The pintles of double plate rudders are to be spaced as required for single plate rudders having an arm at each pintle.

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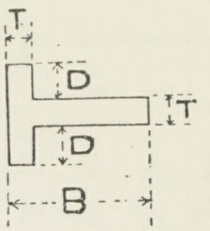
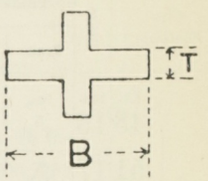
STEERING CHAINS, RODS, QUADRANTS, and TILLERS. TABLE 25.

Diameter of Rudder Head as per Table 22.	Radius of Quadrant.	Diameter of Chains. (*a*)	Diameter of Rods. (*a*)	BOSS OF QUADRANT.		FORGED IRON QUADRANTS AND TILLERS. Sizes of Arms at two Diameters of Rudder head from Centre of Rudder head. (*b*)				CAST STEEL QUADRANT TILLERS.				
				Depth.	Outside Diameter	ONE ARM.	TWO ARMS.	THREE ARMS.	FOUR ARMS.	TWO ARMS.			TWO ARMS.	THREE ARMS.
inches.	feet. inches.	inches.	inches.	inches.	inches.	inches. inches.	inches. inches.	inches. inches.	inches. inches.	B inches.	T inches.	D inches.	B inches. T inches.	B inches. T inches.
$2\frac{3}{4}$	2 10	$\frac{1}{4}$	$\frac{3}{8}$	$2\frac{3}{4}$	$5\frac{1}{4}$	$3\frac{1}{4}\times1\frac{7}{8}$							$6\times1\frac{1}{4}$	
3	3 0	$\frac{3}{8}$	$\frac{1}{2}$	3	$5\frac{1}{2}$	$3\frac{1}{4}\times2$							$6\frac{1}{4}\times1\frac{1}{4}$	
$3\frac{1}{4}$	3 0	$\frac{3}{8}$	$\frac{1}{2}$	$3\frac{1}{4}$	$5\frac{3}{4}$	$3\frac{1}{4}\times2\frac{1}{4}$							$6\frac{1}{2}\times1\frac{3}{8}$	
$3\frac{1}{2}$	3 2	$\frac{7}{16}$	$\frac{9}{16}$	$3\frac{1}{2}$	$6\frac{1}{4}$	$3\frac{1}{2}\times2\frac{1}{2}$							$6\frac{3}{4}\times1\frac{3}{8}$	
$3\frac{3}{4}$	3 2	$\frac{7}{16}$	$\frac{9}{16}$	$3\frac{3}{4}$	$6\frac{3}{4}$	$4\times2\frac{1}{2}$							$7\times1\frac{5}{8}$	
4	3 4	$\frac{1}{2}$	$\frac{5}{8}$	4	$7\frac{1}{4}$	$4\frac{1}{4}\times2\frac{1}{2}$							$7\frac{1}{4}\times1\frac{5}{8}$	
$4\frac{1}{4}$	3 4	$\frac{9}{16}$	$\frac{11}{16}$	$4\frac{1}{4}$	$7\frac{1}{2}$	$4\frac{1}{2}\times2\frac{3}{4}$							$7\frac{1}{2}\times1\frac{3}{4}$	
$4\frac{1}{2}$	3 6	$\frac{9}{16}$	$\frac{11}{16}$	$4\frac{1}{2}$	8	$5\times2\frac{3}{4}$	$3\frac{3}{4}\times2\frac{1}{4}$						$7\frac{3}{4}\times1\frac{3}{4}$	
$4\frac{3}{4}$	3 6	$\frac{5}{8}$	$\frac{13}{16}$	$4\frac{3}{4}$	$8\frac{1}{2}$	$5\frac{1}{4}\times2\frac{3}{4}$	$4\times2\frac{1}{4}$							
5	3 8	$\frac{5}{8}$	$\frac{13}{16}$	5	9	$5\frac{1}{2}\times3$	$4\frac{1}{4}\times2\frac{1}{2}$						$8\times1\frac{3}{8}$	$8\times1\frac{3}{4}$
$5\frac{1}{4}$	3 8	$\frac{11}{16}$	$\frac{14}{16}$	$5\frac{1}{4}$	$9\frac{1}{4}$	$5\frac{3}{4}\times3$	$4\frac{1}{2}\times2\frac{1}{2}$						$8\frac{1}{4}\times1\frac{1}{2}$	$8\frac{1}{4}\times1\frac{7}{8}$
$5\frac{1}{2}$	3 10	$\frac{3}{4}$	$\frac{15}{16}$	$5\frac{1}{2}$	$9\frac{3}{4}$	$6\times3\frac{1}{4}$	$4\frac{3}{4}\times2\frac{1}{2}$						$8\frac{1}{2}\times1\frac{1}{2}$	$8\frac{1}{2}\times1\frac{7}{8}$
$5\frac{3}{4}$	3 10	$\frac{3}{4}$	$\frac{15}{16}$	$5\frac{3}{4}$	$10\frac{1}{4}$	$6\frac{1}{4}\times3\frac{1}{4}$	$5\times2\frac{1}{2}$						$8\frac{3}{4}\times1\frac{5}{8}$	$8\frac{3}{4}\times2$
6	4 0	$\frac{13}{16}$	1	6	$10\frac{3}{4}$	$6\frac{1}{2}\times3\frac{1}{2}$	$5\frac{1}{4}\times2\frac{3}{4}$						$9\times1\frac{5}{8}$	9×2	$8\times1\frac{3}{4}$
$6\frac{1}{4}$	4 0	$\frac{7}{8}$	$1\frac{1}{16}$	$6\frac{1}{4}$	$11\frac{1}{4}$	$6\frac{3}{4}\times3\frac{1}{2}$	$5\frac{1}{2}\times2\frac{3}{4}$						$9\frac{1}{2}\times1\frac{3}{4}$	$9\frac{1}{2}\times2\frac{1}{4}$	$8\frac{1}{2}\times1\frac{7}{8}$
$6\frac{1}{2}$	4 2	$\frac{7}{8}$	$1\frac{1}{16}$	$6\frac{1}{2}$	$11\frac{3}{4}$	$7\times3\frac{3}{4}$	$5\frac{1}{2}\times3$						$10\times1\frac{7}{8}$	$10\times2\frac{3}{8}$	$9\times1\frac{7}{8}$
$6\frac{3}{4}$	4 2	$\frac{15}{16}$	$1\frac{3}{16}$	$6\frac{3}{4}$	12	$7\frac{1}{4}\times3\frac{3}{4}$	$5\frac{3}{4}\times3$						$10\frac{1}{2}\times2$	$10\frac{1}{2}\times2\frac{1}{2}$	$9\frac{1}{2}\times2$
7	4 4	1	$1\frac{1}{4}$	7	$12\frac{1}{2}$	$7\frac{1}{2}\times4$	$6\times3\frac{1}{4}$			$8\times1\frac{3}{8}$	2		$8\times1\frac{3}{4}$	9×2	$8\times1\frac{3}{4}$
$7\frac{1}{4}$	4 4	1	$1\frac{1}{4}$	$7\frac{1}{4}$	13	$7\frac{3}{4}\times4\frac{1}{4}$	$6\times3\frac{1}{2}$			$8\frac{1}{4}\times1\frac{1}{2}$	2		$8\frac{1}{4}\times1\frac{7}{8}$	$9\frac{1}{2}\times2\frac{1}{4}$	$8\frac{1}{2}\times1\frac{7}{8}$
$7\frac{1}{2}$	4 6	$1\frac{1}{16}$	$1\frac{5}{16}$	$7\frac{1}{2}$	$13\frac{1}{2}$	$8\times4\frac{1}{2}$	$6\frac{1}{4}\times3\frac{1}{2}$			$8\frac{1}{2}\times1\frac{1}{2}$	2		$8\frac{1}{2}\times1\frac{7}{8}$	$10\times2\frac{3}{8}$	$9\times1\frac{7}{8}$
$7\frac{3}{4}$	4 6	$1\frac{1}{8}$	$1\frac{3}{8}$	$7\frac{3}{4}$	14	$8\frac{1}{4}\times4\frac{1}{2}$	$6\frac{1}{4}\times3\frac{3}{4}$			$8\frac{3}{4}\times1\frac{5}{8}$	2		$8\frac{3}{4}\times2$	$10\frac{1}{2}\times2\frac{1}{2}$	$9\frac{1}{2}\times2$
8	4 8	$1\frac{1}{8}$	$1\frac{3}{8}$	8	$14\frac{1}{2}$	$8\frac{1}{2}\times4\frac{3}{4}$	$6\frac{1}{2}\times4$	$5\frac{3}{4}\times3\frac{1}{2}$		$9\times1\frac{5}{8}$	$2\frac{1}{4}$		9×2	$8\times1\frac{3}{4}$	$11\times2\frac{1}{8}$	$10\times2\frac{1}{8}$
$8\frac{1}{2}$	5 0	$1\frac{3}{16}$	$1\frac{1}{2}$	$8\frac{1}{2}$	$15\frac{1}{4}$	9×5	7×4	$6\times3\frac{3}{4}$		$9\frac{1}{2}\times1\frac{3}{4}$	$2\frac{1}{4}$		$9\frac{1}{2}\times2\frac{1}{4}$	$8\frac{1}{2}\times1\frac{7}{8}$	$11\frac{1}{2}\times2\frac{3}{8}$	$10\frac{1}{2}\times2\frac{1}{4}$
9	5 4	$1\frac{1}{4}$	$1\frac{9}{16}$	9	$16\frac{1}{4}$	$9\frac{1}{2}\times5\frac{1}{4}$	$7\frac{1}{2}\times4\frac{1}{4}$	$6\frac{1}{2}\times3\frac{3}{4}$		$10\times1\frac{7}{8}$	$2\frac{1}{2}$		$10\times2\frac{3}{8}$	$9\times1\frac{7}{8}$	$12\times2\frac{3}{8}$	$11\times2\frac{3}{8}$
$9\frac{1}{2}$	5 8	$1\frac{3}{8}$	$1\frac{11}{16}$	$9\frac{1}{2}$	17	$10\times5\frac{3}{4}$	$8\times4\frac{1}{2}$	7×4		$10\frac{1}{2}\times2$	$2\frac{1}{2}$		$10\frac{1}{2}\times2\frac{1}{2}$	$9\frac{1}{2}\times2$	$12\frac{1}{2}\times2\frac{1}{2}$	$11\times2\frac{1}{8}$
10	6 0	$1\frac{7}{16}$	$1\frac{3}{4}$	10	18	$10\frac{1}{2}\times6$	$8\frac{1}{2}\times4\frac{1}{2}$	$7\frac{1}{2}\times4$	$7\times3\frac{1}{2}$	$11\times2\frac{1}{8}$	$2\frac{3}{4}$		$11\times2\frac{5}{8}$	$10\times2\frac{1}{8}$	12×3	$11\times2\frac{3}{8}$
$10\frac{1}{2}$	6 4	$1\frac{1}{2}$	$1\frac{7}{8}$	$10\frac{1}{2}$	19	$11\times6\frac{1}{4}$	$9\times4\frac{3}{4}$	8×4	$7\frac{1}{2}\times3\frac{1}{2}$	$11\frac{1}{2}\times2\frac{1}{4}$	$2\frac{3}{4}$		$11\frac{1}{2}\times2\frac{3}{8}$	$10\frac{1}{2}\times2\frac{1}{4}$	$12\frac{1}{2}\times3\frac{1}{8}$	$11\frac{1}{2}\times2\frac{1}{2}$
11	6 8	$1\frac{9}{16}$	$1\frac{15}{16}$	11	$19\frac{3}{4}$	$11\frac{1}{2}\times6\frac{3}{4}$	$9\frac{1}{2}\times5$	$8\frac{1}{4}\times4\frac{1}{2}$	$7\frac{3}{4}\times4$	$12\times2\frac{3}{8}$	3		12×3	$11\times2\frac{3}{8}$	$13\times3\frac{1}{4}$	$12\times2\frac{5}{8}$
$11\frac{1}{2}$	7 4	$1\frac{5}{8}$	2	$11\frac{1}{2}$	$20\frac{3}{4}$	12×7	$10\times5\frac{1}{4}$	$8\frac{1}{2}\times5$	$8\times4\frac{1}{4}$	$12\frac{1}{2}\times2\frac{1}{2}$	3		$12\frac{1}{2}\times3\frac{1}{8}$	$11\frac{1}{2}\times2\frac{1}{2}$	$13\times3\frac{1}{4}$	$12\times2\frac{5}{8}$
12	8 0	$1\frac{5}{8}$	2	12	$21\frac{1}{2}$	$12\frac{1}{2}\times7\frac{1}{2}$	$10\frac{1}{2}\times5\frac{1}{2}$	9×5	$8\frac{1}{2}\times4\frac{1}{2}$	$13\times2\frac{5}{8}$	$3\frac{1}{4}$		$13\times3\frac{1}{4}$	$12\times2\frac{5}{8}$	$13\frac{1}{2}\times3\frac{1}{2}$	$12\frac{1}{2}\times2\frac{3}{4}$
$12\frac{1}{2}$	8 0	—	—	$12\frac{1}{2}$	$22\frac{1}{2}$	$13\times7\frac{1}{2}$	$11\times5\frac{1}{2}$	$9\frac{1}{2}\times5$	$8\frac{3}{4}\times4\frac{1}{2}$	$13\frac{1}{2}\times2\frac{3}{4}$	$3\frac{1}{2}$		$13\frac{1}{2}\times3\frac{1}{2}$	$12\frac{1}{2}\times2\frac{3}{4}$	$14\times3\frac{1}{2}$	$13\times2\frac{3}{4}$
13	8 0	—	—	13	$23\frac{1}{2}$	$13\frac{1}{2}\times7\frac{1}{2}$	$11\frac{1}{4}\times5\frac{3}{4}$	10×5	$9\times4\frac{1}{2}$	$14\times2\frac{3}{4}$	$3\frac{1}{2}$		$14\times3\frac{1}{2}$	$13\times2\frac{3}{4}$	$14\frac{1}{2}\times3\frac{3}{4}$	$13\frac{1}{2}\times3$
$13\frac{1}{2}$	8 0	—	—	$13\frac{1}{2}$	$24\frac{1}{2}$	14×8	$11\frac{1}{2}\times6$	$10\times5\frac{1}{4}$	$9\times4\frac{3}{4}$	$14\frac{1}{2}\times3$	$3\frac{3}{4}$		$14\frac{1}{2}\times3\frac{3}{4}$	$13\frac{1}{2}\times3$	$15\times3\frac{3}{4}$	14×3
14	8 0	—	—	14	$25\frac{1}{4}$	$14\frac{1}{2}\times8$	12×6	$10\frac{1}{2}\times5\frac{1}{4}$	$9\frac{1}{2}\times4\frac{3}{4}$	15×3	$3\frac{3}{4}$		$15\times3\frac{3}{4}$	14×3	$15\frac{1}{2}\times4$	$14\frac{1}{2}\times3\frac{1}{4}$
$14\frac{1}{2}$	8 0	—	—	$14\frac{1}{2}$	$26\frac{1}{4}$	$15\times8\frac{1}{2}$	$12\frac{1}{4}\times6\frac{1}{2}$	$10\frac{1}{2}\times5\frac{1}{2}$	$9\frac{1}{2}\times5$	$15\frac{1}{2}\times3\frac{1}{4}$	4		$15\frac{1}{2}\times4$	$14\frac{1}{2}\times3\frac{1}{4}$	16×4	$15\times3\frac{1}{4}$
15	8 0	—	—	15	27	$15\frac{1}{2}\times8\frac{1}{2}$	$12\frac{3}{4}\times6\frac{1}{2}$	$11\times5\frac{1}{2}$	10×5	$16\times3\frac{1}{4}$	4		16×4	$15\times3\frac{1}{4}$		





(*a*) Where the radius of quadrant or length of tiller adopted, differs from that given in the Table, the diameter of steering chain is to be calculated from the following formula:—

$$d = \cdot 38\sqrt{\frac{D^3}{R}};$$

where d=diameter of chain in inches;
D=diameter of rudder head in inches according to Table for rudder heads.
R=radius of quadrant or length of tiller at centre of the chain in inches.

The steering rods to be one-fourth larger in diameter than the chain, or of the corresponding diameter given in the Table for the chain required.

(*b*) The sizes of arms at ends may be reduced to three-fourths of the dimensions given in the Table, and where a quadrant tiller is not keyed to the rudder head, the arms of the same may be of these reduced dimensions throughout their lengths.

The diameters at the centre of the chain of leading block sheaves are not to be less than sixteen times that of the steering chains and the pins of the sheaves are to be not less than twice the diameter of the chains.

LLOYD'S REGISTER OF SHIPPING, LONDON.—*17th June, 1909.*

MASTS and BOWSPRITS of SAILING VESSELS and FULL-RIGGED STEAM VESSELS. TABLE 26.

IRON AND STEEL MASTS.

	EXTREME LENGTH. (See Footnote.)	PARTNERS. Diam.	PARTNERS. Thickness. Iron.	PARTNERS. Thickness. Steel.	HEEL. Diam.	HEEL. Thickness. Iron.	HEEL. Thickness. Steel.	HOUNDS. Diam.	HOUNDS. Thickness. Iron.	HOUNDS. Thickness. Steel.	HEAD. Diam.	HEAD. Thickness. Iron.	HEAD. Thickness. Steel.	Sizes of Angle Bars in Masts. Iron.	Sizes of Angle Bars in Masts. Steel.	CHEEKS. Th'kn'ss of Plate Irn.	CHEEKS. Th'kn'ss of Plate Stl.	CHEEKS. Sizes of Angle Bar. Iron.	CHEEKS. Sizes of Angle Bar. Steel.
	Ft.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.
Two Plates in the Round.	48	16	$\frac{5}{16}$	$\frac{6}{20}$	13	$\frac{4}{16}$	$\frac{5}{20}$	$13\frac{1}{2}$	$\frac{4}{16}$	$\frac{5}{20}$	11	$\frac{3}{16}$	$\frac{5}{20}$	...	...	$\frac{7}{16}$	$\frac{8}{20}$	$3\frac{1}{2}\times2\frac{1}{2}\times\frac{6}{16}$	$3\frac{1}{2}\times2\frac{1}{2}\times\frac{7}{20}$
	51	17	$\frac{5}{16}$	$\frac{6}{20}$	$13\frac{1}{2}$	$\frac{4}{16}$	$\frac{5}{20}$	14	$\frac{4}{16}$	$\frac{5}{20}$	$11\frac{1}{2}$	$\frac{4}{16}$	$\frac{5}{20}$	...	...	$\frac{7}{16}$	$\frac{8}{20}$	$3\frac{1}{2}\times3\times\frac{6}{16}$	$3\frac{1}{2}\times3\times\frac{7}{20}$
	54	18	$\frac{5}{16}$	$\frac{6}{20}$	14	$\frac{4}{16}$	$\frac{5}{20}$	15	$\frac{4}{16}$	$\frac{5}{20}$	12	$\frac{4}{16}$	$\frac{5}{20}$	...	...	$\frac{7}{16}$	$\frac{8}{20}$	$3\frac{1}{2}\times3\times\frac{6}{16}$	$3\frac{1}{2}\times3\times\frac{7}{20}$
	57	19	$\frac{6}{16}$	$\frac{7}{20}$	15	$\frac{5}{16}$	$\frac{6}{20}$	$15\frac{1}{2}$	$\frac{5}{16}$	$\frac{6}{20}$	$12\frac{1}{2}$	$\frac{4}{16}$	$\frac{5}{20}$	...	...	$\frac{8}{16}$	$\frac{9}{20}$	$4\times3\times\frac{7}{16}$	$4\times3\times\frac{8}{20}$
	60	20	$\frac{6}{16}$	$\frac{7}{20}$	16	$\frac{5}{16}$	$\frac{6}{20}$	$16\frac{1}{2}$	$\frac{5}{16}$	$\frac{6}{20}$	$13\frac{1}{2}$	$\frac{5}{16}$	$\frac{6}{20}$	...	...	$\frac{8}{16}$	$\frac{9}{20}$	$4\times3\times\frac{7}{16}$	$4\times3\times\frac{8}{20}$
	63	21	$\frac{6}{16}$	$\frac{7}{20}$	$16\frac{1}{2}$	$\frac{5}{16}$	$\frac{6}{20}$	$17\frac{1}{2}$	$\frac{5}{16}$	$\frac{6}{20}$	14	$\frac{5}{16}$	$\frac{6}{20}$	...	...	$\frac{8}{16}$	$\frac{9}{20}$	$4\times3\times\frac{7}{16}$	$4\times3\times\frac{8}{20}$
	66	22	$\frac{6}{16}$	$\frac{7}{20}$	17	$\frac{5}{16}$	$\frac{6}{20}$	$18\frac{1}{2}$	$\frac{5}{16}$	$\frac{6}{20}$	$14\frac{1}{2}$	$\frac{5}{16}$	$\frac{6}{20}$	...	...	$\frac{8}{16}$	$\frac{9}{20}$	$4\frac{1}{2}\times3\times\frac{7}{16}$	$4\frac{1}{2}\times3\times\frac{8}{20}$
	69	23	$\frac{6}{16}$	$\frac{7}{20}$	18	$\frac{5}{16}$	$\frac{6}{20}$	19	$\frac{5}{16}$	$\frac{6}{20}$	$15\frac{1}{2}$	$\frac{5}{16}$	$\frac{6}{20}$	...	...	$\frac{8}{16}$	$\frac{9}{20}$	$4\frac{1}{2}\times3\times\frac{8}{16}$	$4\frac{1}{2}\times3\times\frac{9}{20}$
	72	24	$\frac{6}{16}$	$\frac{7}{20}$	19	$\frac{5}{16}$	$\frac{6}{20}$	20	$\frac{5}{16}$	$\frac{6}{20}$	16	$\frac{5}{16}$	$\frac{6}{20}$	...	...	$\frac{8}{16}$	$\frac{9}{20}$	$4\frac{1}{2}\times3\times\frac{8}{16}$	$4\frac{1}{2}\times3\times\frac{9}{20}$
Three Plates in the Round.	75	25	$\frac{7}{16}$	$\frac{8}{20}$	$19\frac{1}{2}$	$\frac{6}{16}$	$\frac{7}{20}$	21	$\frac{6}{16}$	$\frac{7}{20}$	$16\frac{1}{2}$	$\frac{6}{16}$	$\frac{7}{20}$	...	...	$\frac{9}{16}$	$\frac{10}{20}$	$5\times3\times\frac{8}{16}$	$5\times3\times\frac{9}{20}$
	78	26	$\frac{7}{16}$	$\frac{8}{20}$	20	$\frac{6}{16}$	$\frac{7}{20}$	$21\frac{1}{2}$	$\frac{6}{16}$	$\frac{7}{20}$	$17\frac{1}{2}$	$\frac{6}{16}$	$\frac{7}{20}$	...	...	$\frac{9}{16}$	$\frac{10}{20}$	$5\times3\times\frac{9}{16}$	$5\times3\times\frac{10}{20}$
	81	27	$\frac{8}{16}$	$\frac{9}{20}$	21	$\frac{6}{16}$	$\frac{7}{20}$	$22\frac{1}{2}$	$\frac{6}{16}$	$\frac{7}{20}$	18	$\frac{6}{16}$	$\frac{7}{20}$	...	...	$\frac{9}{16}$	$\frac{10}{20}$	$5\times3\frac{1}{2}\times\frac{9}{16}$	$5\times3\frac{1}{2}\times\frac{10}{20}$
	84	28	$\frac{8}{16}$	$\frac{9}{20}$	22	$\frac{6}{16}$	$\frac{7}{20}$	23	$\frac{6}{16}$	$\frac{7}{20}$	$18\frac{1}{2}$	$\frac{6}{16}$	$\frac{7}{20}$	$3\frac{1}{2}\times3\times\frac{7}{16}$	$3\frac{1}{2}\times3\times\frac{8}{20}$	$\frac{10}{16}$	$\frac{11}{20}$	$5\times3\frac{1}{2}\times\frac{9}{16}$	$5\times3\frac{1}{2}\times\frac{10}{20}$
	87	29	$\frac{8}{16}$	$\frac{9}{20}$	$22\frac{1}{2}$	$\frac{6}{16}$	$\frac{7}{20}$	24	$\frac{6}{16}$	$\frac{7}{20}$	$19\frac{1}{2}$	$\frac{6}{16}$	$\frac{7}{20}$	$4\times3\times\frac{7}{16}$	$4\times3\times\frac{8}{20}$	$\frac{10}{16}$	$\frac{11}{20}$	$5\frac{1}{2}\times4\times\frac{10}{16}$	$5\frac{1}{2}\times4\times\frac{11}{20}$
	90	30	$\frac{8}{16}$	$\frac{9}{20}$	23	$\frac{7}{16}$	$\frac{8}{20}$	25	$\frac{7}{16}$	$\frac{8}{20}$	20	$\frac{6}{16}$	$\frac{7}{20}$	$4\times3\times\frac{8}{16}$	$4\times3\times\frac{9}{20}$	$\frac{10}{16}$	$\frac{11}{20}$	$6\times4\times\frac{10}{16}$	$6\times4\times\frac{11}{20}$
	93	31	$\frac{9}{16}$	$\frac{10}{20}$	24	$\frac{7}{16}$	$\frac{8}{20}$	26	$\frac{7}{16}$	$\frac{8}{20}$	$20\frac{1}{2}$	$\frac{6}{16}$	$\frac{7}{20}$	$4\frac{1}{2}\times3\times\frac{8}{16}$	$4\frac{1}{2}\times3\times\frac{9}{20}$	$\frac{11}{16}$	$\frac{12}{20}$	$6\times4\times\frac{10}{16}$	$6\times4\times\frac{11}{20}$
	96	32	$\frac{9}{16}$	$\frac{10}{20}$	25	$\frac{7}{16}$	$\frac{8}{20}$	$26\frac{1}{2}$	$\frac{7}{16}$	$\frac{8}{20}$	21	$\frac{6}{16}$	$\frac{7}{20}$	$5\times3\times\frac{8}{16}$	$5\times3\times\frac{9}{20}$	$\frac{11}{16}$	$\frac{12}{20}$	$6\times4\times\frac{10}{16}$	$6\times4\times\frac{11}{20}$

IRON AND STEEL BOWSPRITS.

LENGTH OUTSIDE BED.	BED. Diam.	BED. Th'kn'ss Irn.	BED. Th'kn'ss Stl.	HEEL. Diam.	HEEL. Th'kn'ss Irn.	HEEL. Th'kn'ss Stl.	CAP. Diam.	CAP. Th'kn'ss Irn.	CAP. Th'kn'ss Stl.	Sizes of Angle Bar. Iron.	Sizes of Angle Bar. Steel.
Ft.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.
14	$16\frac{1}{2}$	$\frac{5}{16}$	$\frac{6}{20}$	14	$\frac{5}{16}$	$\frac{6}{20}$	12	$\frac{4}{16}$	$\frac{5}{20}$	$2\frac{1}{2}\times2\times\frac{5}{16}$	$2\frac{1}{2}\times2\times\frac{6}{20}$
15	$17\frac{1}{2}$	$\frac{5}{16}$	$\frac{6}{20}$	15	$\frac{5}{16}$	$\frac{6}{20}$	$12\frac{1}{2}$	$\frac{5}{16}$	$\frac{6}{20}$	$2\frac{1}{2}\times2\times\frac{5}{16}$	$2\frac{1}{2}\times2\times\frac{6}{20}$
16	19	$\frac{5}{16}$	$\frac{6}{20}$	16	$\frac{5}{16}$	$\frac{6}{20}$	13	$\frac{5}{16}$	$\frac{6}{20}$	$3\times2\times\frac{5}{16}$	$3\times2\times\frac{6}{20}$
17	20	$\frac{6}{16}$	$\frac{7}{20}$	17	$\frac{6}{16}$	$\frac{7}{20}$	14	$\frac{5}{16}$	$\frac{6}{20}$	$3\times2\times\frac{5}{16}$	$3\times2\times\frac{6}{20}$
18	$21\frac{1}{2}$	$\frac{6}{16}$	$\frac{7}{20}$	18	$\frac{6}{16}$	$\frac{7}{20}$	15	$\frac{5}{16}$	$\frac{6}{20}$	$3\times2\frac{1}{2}\times\frac{5}{16}$	$3\times2\frac{1}{2}\times\frac{6}{20}$
19	23	$\frac{6}{16}$	$\frac{7}{20}$	19	$\frac{6}{16}$	$\frac{7}{20}$	16	$\frac{5}{16}$	$\frac{6}{20}$	$3\times3\times\frac{6}{16}$	$3\times3\times\frac{7}{20}$
20	$24\frac{1}{2}$	$\frac{7}{16}$	$\frac{8}{20}$	20	$\frac{6}{16}$	$\frac{7}{20}$	$16\frac{1}{2}$	$\frac{6}{16}$	$\frac{7}{20}$	$3\frac{1}{2}\times3\times\frac{6}{16}$	$3\frac{1}{2}\times3\times\frac{7}{20}$

LENGTH OUTSIDE BED.	BED. Diam.	BED. Th'kn'ss Irn.	BED. Th'kn'ss Stl.	HEEL. Diam.	HEEL. Th'kn'ss Irn.	HEEL. Th'kn'ss Stl.	CAP. Diam.	CAP. Th'kn'ss Irn.	CAP. Th'kn'ss Stl.	Sizes of Angle Bar. Iron.	Sizes of Angle Bar. Steel.
Ft.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.
21	$25\frac{1}{2}$	$\frac{7}{16}$	$\frac{8}{20}$	21	$\frac{6}{16}$	$\frac{7}{20}$	$17\frac{1}{2}$	$\frac{6}{16}$	$\frac{7}{20}$	$3\frac{1}{2}\times3\times\frac{6}{16}$	$3\frac{1}{2}\times3\times\frac{7}{20}$
22	$26\frac{1}{2}$	$\frac{7}{16}$	$\frac{8}{20}$	22	$\frac{6}{16}$	$\frac{7}{20}$	$18\frac{1}{2}$	$\frac{6}{16}$	$\frac{7}{20}$	$4\times3\times\frac{7}{16}$	$4\times3\times\frac{8}{20}$
23	28	$\frac{8}{16}$	$\frac{9}{20}$	23	$\frac{7}{16}$	$\frac{8}{20}$	19	$\frac{6}{16}$	$\frac{7}{20}$	$4\times3\frac{1}{2}\times\frac{7}{16}$	$4\times3\frac{1}{2}\times\frac{8}{20}$
24	29	$\frac{8}{16}$	$\frac{9}{20}$	24	$\frac{7}{16}$	$\frac{8}{20}$	20	$\frac{6}{16}$	$\frac{7}{20}$	$4\times3\frac{1}{2}\times\frac{7}{16}$	$4\times3\frac{1}{2}\times\frac{8}{20}$
25	30	$\frac{8}{16}$	$\frac{9}{20}$	25	$\frac{7}{16}$	$\frac{8}{20}$	21	$\frac{6}{16}$	$\frac{7}{20}$	$4\frac{1}{2}\times3\frac{1}{2}\times\frac{8}{16}$	$4\frac{1}{2}\times3\frac{1}{2}\times\frac{9}{20}$
26	$31\frac{1}{2}$	$\frac{8}{16}$	$\frac{9}{20}$	26	$\frac{7}{16}$	$\frac{8}{20}$	$21\frac{1}{2}$	$\frac{6}{16}$	$\frac{7}{20}$	$4\frac{1}{2}\times3\frac{1}{2}\times\frac{8}{16}$	$4\frac{1}{2}\times3\frac{1}{2}\times\frac{9}{20}$
27	33	$\frac{8}{16}$	$\frac{9}{20}$	27	$\frac{7}{16}$	$\frac{8}{20}$	22	$\frac{6}{16}$	$\frac{7}{20}$	$4\frac{1}{2}\times3\frac{1}{2}\times\frac{8}{16}$	$4\frac{1}{2}\times3\frac{1}{2}\times\frac{9}{20}$

FOOTNOTE.—The length for regulating the scantlings of the mast to be taken, in all cases, from the cap to the top of the keelson.

RULES FOR THE CONSTRUCTION OF IRON AND STEEL MASTS, BOWSPRITS, AND YARDS.

(Tables 26 and 27.)

1. If Iron be used in the construction of masts, bowsprits, and yards, it is to be of good malleable quality quite free from surface or other defects, and to stand a tensile strain of 20 tons to the square inch and the following bending tests when cold without fracture:—

Thickness of Plates	To Bend Cold through an Angle of	
	With the Grain.	Across the Grain.
$\frac{9}{16}$	25°	8°
$\frac{8}{16}$	30°	11°
$\frac{7}{16}$	37°	13°
$\frac{6}{16}$	47°	15°
$\frac{5}{16}$	55°	17°
$\frac{4}{16}$	65°	20°
$\frac{3}{16}$	70°	25°

2. The plates to be bent over a slab, the corner of which should be rounded with a radius of half an inch.

3. If Steel be adopted it is to be of the quality required for ship plates and subjected to the same tests.

4. Lower Masts.—The plating to be of the thickness, and the plates arranged as in the Table. The seams to be double riveted; in masts not exceeding 84 feet in length, the edges may be single riveted provided angle bars be fitted to the satisfaction of the Committee. The butts below the mast partners in masts, and those inside the wedging of bowsprits, might be double riveted, the remainder should be treble riveted.

5. The buttstraps in all cases should be $\frac{1}{16}$ of an inch thicker than the plates they connect in iron masts; in steel masts the buttstraps should be $\frac{1}{20}$ of an inch thicker than the plates in double riveted butts and $\frac{2}{20}$ thicker in treble riveted butts. The buttstraps would be better to be fitted on the outside of the masts and bowsprit.

6. The mast and bowsprit plates should be doubled all round in way of the wedging, or otherwise efficiently strengthened; where masts are wedged at the lower deck, the doubling should extend from below the lower deck to above the upper deck.

7. The heels of all masts and their steps should be efficiently strengthened. The cheeks of masts should be stiffened by angles or cope iron on their foremost edges; or by some other approved plan.

8. Where two plates in the round are adopted instead of three the iron is to be of such superior quality as to admit of its being bent to the required form, without being unduly heated and without fracture, and in all such cases the masts should be additionally stiffened by 3 angles as provided for in the Tables.

9. All masts of above 84 feet in length, to be fitted with angles properly shifted and extending the whole length of the mast. If the plates be arranged as described in the Tables, there should be an angle bar fitted to each plate in the round, of the size given in the Table.

10. All bowsprits exceeding 28 inches in diameter should have a vertical diaphragm plate extending from within the wedging to the gammoning, connected by continuous single angle bars to the upper and lower parts of the bowsprit, and two additional angle bars of the size given in the Table; and bowsprits 28 inches in diameter and under, to have an angle bar at the centre of each plate extending the whole length of the bowsprit.

11. The diameter of the lower masts at the cap to be in no case less than that of the topmast at this place, or of the lower topsail yard.

12. The attention of the Surveyors is to be specially directed to the fittings connected with the masts and rigging, in order to ensure the workmanship, material, and sizes of the same being efficient.

13. The mizenmasts for barques may be reduced one-fifth in diameter from that given in the Table, and the plating to be not less than the thickness corresponding to the diameters.

14. Where a Steamer is intended to be fitted with masts or a bowsprit for auxiliary purposes, they may be one-eighth less in diameter than prescribed by Table; and when a mast of a steamer is to carry fore and aft sail only, the diameter may be one-fifth less than given in the Table. The seams of these masts may be single riveted.

15. When pole masts are fitted, the length of the lower mast, in determining the diameter and thickness of plating, should be taken from the heel to the cap band, so as to include the head, as in an ordinary mast; and in sailing vessels these masts to be additionally strengthened by angles from below the lower yard to the topmast cap, or compensating strength furnished. The cheek plates in pole masts may be of the same thickness as the mast plates at the hounds.

16. The eye-bolts, hoops, cleats and bands, are to be of the best description of wrought iron.

17. Any deviations from these Rules and Tables must be submitted for the consideration of the Committee.

Lloyd's Register of Shipping, London.—*11th May, 1911.*

TABLE 27.

YARDS and TOPMASTS of SAILING VESSELS and FULL-RIGGED STEAM VESSELS.

YARDS.

Length Cleated	Centre.			First Quarter.			Second Quarter.			Third Quarter.			Ends at Cleats.		
	Diameter.	Thickness.		Diameter.	Thickness.		Diameter.	Thickness.		Diameter.	Thickness.		Diameter.	Thickness.	
		Iron.	Steel.		Iron.	Steel.		Iron.	Steel		Iron.	Steel.		Iron.	Steel.
Feet.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.
32	8	3/16	3/16	7 7/8	3/16	3/16	7 1/4	3/16	3/16	6	3/16	3/16	4	2/16	2/16
36	9	3/16	3/16	8 3/4	3/16	3/16	8 1/8	3/16	3/16	6 3/4	3/16	3/16	4 1/2	2/16	2/16
40	10	3/16	3/16	9 3/4	3/16	3/16	9	3/16	3/16	7 1/2	3/16	3/16	5	2/16	2/16
44	11	3/16	3/16	10 3/4	3/16	3/16	10	3/16	3/16	8 1/4	3/16	3/16	5 1/2	2/16	2/16
48	12	4/16	5/20	11 3/4	4/16	5/20	10 3/4	3/16	3/16	9	3/16	3/16	6	2/16	2/16
52	13	4/16	5/20	12 5/8	4/16	5/20	11 3/4	3/16	3/16	9 3/4	3/16	3/16	6 1/2	2/16	2/16
56	14	4/16	5/20	13 5/8	4/16	5/20	12 5/8	4/16	5/20	10 1/2	3/16	3/16	7	2/16	2/16
60	15	4/16	5/20	14 5/8	4/16	5/20	13 1/2	4/16	5/20	11 1/4	3/16	3/16	7 1/2	2/16	2/16
64	16	5/16	6/20	15 5/8	5/16	6/20	14 3/8	5/16	6/20	12	4/16	5/20	8	3/16	3/16
68	17	5/16	6/20	16 1/2	5/16	6/20	15 1/4	5/16	6/20	12 3/4	4/16	5/20	8 1/2	3/16	3/16
72	18	5/16	6/20	17 1/2	5/16	6/20	16 1/4	5/16	6/20	13 1/2	4/16	5/20	9	3/16	3/16
76	19	6/16	7/20	18 1/2	5/16	6/20	17 1/8	5/16	6/20	14 1/4	4/16	5/20	9 1/2	3/16	3/16
80	20	6/16	7/20	19 1/2	5/16	6/20	18	5/16	6/20	15	4/16	5/20	10	3/16	3/16
84	21	7/16	8/20	20 1/2	6/16	7/20	19	5/16	6/20	15 3/4	5/16	6/20	10 1/2	4/16	5/20
88	22	7/16	8/20	21 1/2	6/16	7/20	19 3/4	5/16	6/20	16 1/2	5/16	6/20	11	4/16	5/20
92	23	7/16	8/20	22 1/2	6/16	7/20	20 3/4	6/16	7/20	17 1/4	5/16	6/20	11 1/2	4/16	5/20
96	24	7/16	8/20	23 3/8	6/16	7/20	21 5/8	6/16	7/20	18	5/16	6/20	12	4/16	5/20

TOPMASTS.

Length.	Heel.			Lower Part of Head.			Head.		
	Diameter.	Thickness.		Diameter.	Thickness.		Diameter.	Thickness.	
		Iron.	Steel.		Iron.	Steel.		Iron.	Steel.
Feet.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.
32	12	4/16	5/20	10 1/2	4/16	5/20	9	3/16	3/16
34	12 1/2	4/16	5/20	11	4/16	5/20	9 1/2	3/16	3/16
36	13	4/16	5/20	11 1/2	4/16	5/20	10	3/16	3/16
38	14	4/16	5/20	12 1/2	4/16	5/20	10 1/2	3/16	3/16
40	14 1/2	4/16	5/20	13	4/16	5/20	11	3/16	3/16
42	15	5/16	6/20	13 1/2	4/16	5/20	11 1/2	4/16	5/20
44	16	5/16	6/20	14	4/16	5/20	12	4/16	5/20
46	16 1/2	5/16	6/20	14 1/2	4/16	5/20	12 1/2	4/16	5/20
48	17	6/16	7/20	15	5/16	6/20	13	5/16	6/20
50	18	6/16	7/20	16	5/16	6/20	13 1/2	5/16	6/20
52	18 1/2	6/16	7/20	16 1/2	5/16	6/20	14	5/16	6/20
54	19	6/16	7/20	17	5/16	6/20	14 1/2	5/16	6/20
56	20	6/16	7/20	18	5/16	6/20	15	5/16	6/20
58	20 1/2	6/16	7/20	18 1/2	5/16	6/20	15 1/2	5/16	6/20
60	21	6/16	7/20	19	5/16	6/20	16	5/16	6/20
62	22	6/16	7/20	20	5/16	6/20	16 1/2	5/16	6/20
64	23	6/16	7/20	21	5/16	6/20	17	5/16	6/20

Topmasts.—The plating should be of the thickness given in the Table The seams of topmasts may be single riveted; the butts should be treble riveted, and their straps $\frac{1}{16}$ of an inch thicker in iron topmasts, and $\frac{1}{20}$ thicker in steel than the plates they connect. There should be doubling plates in the way of the lower mast cap. Topmasts should be efficiently strengthened in the way of the fid holes, and in the way of sheave holes where such are cut, by the doubling plates, iron hoops, or by other approved methods.

Topmasts above 38 feet in length and not exceeding 46 feet, to have two stiffening angles $3'' \times 2\frac{1}{2}'' \times \frac{6}{16}''$ fitted as nearly as practicable at the fore and after parts of the mast.

Where the length is above 46 feet and not exceeding 66 feet, the angles to be $3\frac{1}{2}'' \times 3\frac{1}{2}'' \times \frac{6}{16}''$.

When the length of the topmasts exceeds 46 feet, efficient cheek plates are to be fitted to the same.

The diameter of the topmasts at the lower cap, sheave hole, and topmast cap, to be in no case less than that of the yards at these places.

Lower Yards.—The plating should be of the thickness given in the Table. The seams of yards may be single riveted; their butts should be treble riveted, and connected by being overlapped, or by efficient butt straps. The plates should be doubled at the centre, and the doubling plates should extend beyond the truss hoops.

Where iron or steel masts and yards are to be constructed otherwise than in accordance with the Tables, plans and particulars of the same must be submitted for the approval of the Committee.

Where Steamers are intended to be fitted with topmasts for auxiliary purposes, they might be one-eighth less in diameter than prescribed by Table.

LLOYD'S REGISTER OF SHIPPING, LONDON.—*11th May, 1911.*

SIZES and TESTS for the STEEL WIRE STANDING RIGGING, &c., of SAILING SHIPS.

TABLE 28.

(See Continuation.)

REGISTER TONNAGE UNDER DECK.	Tons. Above 3000 and not exceeding 3500		Tons. Above 2600 and not exceeding 3000		Tons. Above 2300 and not exceeding 2600		Tons. Above 2000 and not exceeding 2300		Tons. Above 1800 and not exceeding 2000		Tons. Above 1600 and not exceeding 1800		Tons. Above 1400 and not exceeding 1600	
LONGITUDINAL NUMBER.	Above 24200 and not exceeding 27200		Above 21900 and not exceeding 24200		Above 20000 and not exceeding 21900		Above 18400 and not exceeding 20000		Above 17000 and not exceeding 18400		Above 15600 and not exceeding 17000		Above 14200 and not exceeding 15600	
	No.	Size. inches.	No.	Size. inches.	No.	Size. inches.	No.	Size. inches.	No.	Size. inches.	No.	Size. inches.	No.	Size. inches.
Fore & Main Shrouds	6 and 2 cap	$5\frac{1}{2}$ / $2\frac{3}{4}$	6 and 2 cap	$5\frac{1}{4}$ / $2\frac{5}{8}$	6 and cap	5 / $2\frac{1}{2}$	6 and cap	$4\frac{7}{8}$ / $2\frac{3}{8}$	6 and cap	$4\frac{3}{4}$ / $2\frac{1}{4}$	6 and cap	$4\frac{1}{2}$ / $2\frac{1}{8}$	6 and cap	$4\frac{1}{4}$ / 2
,, ,, Chain plates		—		—		—		—		12×7		$11\frac{1}{2}\times6\frac{1}{2}$		11×6
,, ,, Dead-eyes		—		—		—		—		6		$5\frac{3}{4}$		$5\frac{1}{2}$
,, ,, Lanyards (hemp)		—		—		—		—						
,, ,, {Rigging Screws, Diameter at bottom of thread}		$2\frac{1}{4}$		$2\frac{1}{8}$		2		$1\frac{7}{8}$		$1\frac{7}{8}$		$1\frac{3}{4}$		$1\frac{3}{4}$
,, ,, Rigging Screws, Diameter of Pins ...		2		$1\frac{7}{8}$		$1\frac{3}{4}$		$1\frac{5}{8}$		$1\frac{5}{8}$		$1\frac{1}{2}$		$1\frac{1}{2}$
,, ,, Topmast backstays	3	$5\frac{1}{2}$	3	$5\frac{1}{4}$	3	5	3	$4\frac{7}{8}$	3	$4\frac{3}{4}$	3	$4\frac{1}{2}$	3	$4\frac{1}{4}$
,, ,, Top-gallant backstays	2	$4\frac{1}{4}$	2	$4\frac{1}{8}$	2	$3\frac{7}{8}$	2	$3\frac{3}{4}$	2	$3\frac{1}{2}$	2	$3\frac{1}{4}$	2	3
,, ,, Lower stays	2	$5\frac{1}{2}$	2	$5\frac{1}{4}$	2	5	2	$4\frac{7}{8}$	2	$4\frac{3}{4}$	2	$4\frac{1}{2}$	2	$4\frac{1}{4}$
,, ,, Topmast stays	2	$5\frac{1}{2}$	2	$5\frac{1}{4}$	2	5	2	$4\frac{7}{8}$	2	$4\frac{3}{4}$	2	$4\frac{1}{2}$	2	$4\frac{1}{4}$
,, ,, Top-gallant stays		$4\frac{1}{4}$		$4\frac{1}{8}$		$3\frac{7}{8}$		$3\frac{3}{4}$		$3\frac{1}{2}$		$3\frac{1}{4}$		3
Mizen Shrouds	5 and cap	$4\frac{1}{2}$ / 3 $4\frac{1}{2}$	5 and cap	$4\frac{3}{8}$ / 3 $4\frac{3}{8}$	5 and cap	$4\frac{1}{4}$ / 3 $4\frac{1}{4}$	5 and cap	$4\frac{1}{8}$ / 3 $4\frac{1}{8}$	5 and cap	4 / 3 4	5 and cap	$3\frac{3}{4}$ / 3 $3\frac{3}{4}$	5 and cap	$3\frac{1}{2}$ / 3 $3\frac{1}{2}$
,, Topmast backstays														
,, Top-gallant backstays	2	$3\frac{1}{4}$	2	$3\frac{1}{8}$	2	3	2	$2\frac{7}{8}$	2	$2\frac{3}{4}$	2	$2\frac{1}{2}$	2	$2\frac{1}{4}$
,, Lower stays	2	$4\frac{1}{2}$	2	$4\frac{3}{8}$	2	$4\frac{1}{4}$	2	$4\frac{1}{8}$	2	4	2	$3\frac{3}{4}$	2	$3\frac{1}{2}$
,, Topmast stays	2	$4\frac{1}{2}$	2	$4\frac{3}{8}$	2	$4\frac{1}{4}$	2	$4\frac{1}{8}$	2	4	2	$3\frac{3}{4}$	2	$3\frac{1}{2}$
,, Top-gallant stays		$3\frac{1}{4}$		$3\frac{1}{8}$		3		$2\frac{7}{8}$		$2\frac{3}{4}$		$2\frac{1}{2}$		$2\frac{1}{4}$
Bobstay Bar		$4\frac{1}{8}$		$4\frac{1}{8}$		4		$3\frac{7}{8}$		$3\frac{3}{4}$		$3\frac{5}{8}$		$3\frac{1}{2}$
,, Pin		$3\frac{1}{8}$		$3\frac{1}{8}$		3		$2\frac{7}{8}$		$2\frac{3}{4}$		$2\frac{5}{8}$		$2\frac{1}{2}$
,, Chain		$2\frac{1}{16}$		$2\frac{1}{16}$		2		$1\frac{15}{16}$		$1\frac{14}{16}$		$1\frac{13}{16}$		$1\frac{12}{16}$
Bowsprit Shrouds (Chain)	2	$1\frac{1}{8}$	2	$1\frac{1}{8}$	2	$1\frac{1}{16}$	2	$1\frac{1}{16}$	2	1	2	1	2	$\frac{7}{8}$

STEEL WIRE STANDING RIGGING.

Size (inches)	$5\frac{1}{2}$	$5\frac{1}{4}$	5	$4\frac{7}{8}$	$4\frac{3}{4}$	$4\frac{5}{8}$	$4\frac{1}{2}$	$4\frac{3}{8}$	$4\frac{1}{4}$	$4\frac{1}{8}$	4	$3\frac{7}{8}$	$3\frac{3}{4}$	$3\frac{5}{8}$	$3\frac{1}{2}$	$3\frac{3}{8}$	$3\frac{1}{4}$
Breaking Test (tons)	58	53	48	44	42	40	38	36	34	32	30	28	26	24	22	$20\frac{1}{2}$	19
Size (inches)	$3\frac{1}{8}$	3	$2\frac{7}{8}$	$2\frac{3}{4}$	$2\frac{5}{8}$	$2\frac{1}{2}$	$2\frac{3}{8}$	$2\frac{1}{4}$	$2\frac{1}{8}$	2	$1\frac{7}{8}$	$1\frac{3}{4}$	$1\frac{5}{8}$	$1\frac{1}{2}$	$1\frac{3}{8}$	$1\frac{1}{4}$	
Breaking Test (tons)	$17\frac{1}{2}$	16	$14\frac{1}{2}$	13	12	11	10	9	8	7	6	$5\frac{1}{2}$	5	4	$3\frac{1}{4}$	3	

SIZES and TESTS for the STEEL WIRE STANDING RIGGING, &c., of SAILING SHIPS.

TABLE 28.

(Concluded.)

REGISTER TONNAGE UNDER DECK.	Tons. Above 1200 and not exceeding 1400	Tons. Above 1000 and not exceeding 1200	Tons. Above 800 and not exceeding 1000	Tons. Above 700 and not exceeding 800	Tons. Above 600 and not exceeding 700	Tons. Above 500 and not exceeding 600	Tons. Above 400 and not exceeding 500	Tons. Above 300 and not exceeding 400
LONGITUDINAL NUMBER.	Above 12800 and not exceeding 14200	Above 11400 and not exceeding 12800	Above 10000 and not exceeding 11400	Above 9000 and not exceeding 10000	Above 8000 and not exceeding 9000	Above 7100 and not exceeding 8000	Above 6200 and not exceeding 7100	Above 4900 and not exceeding 6200
	No. Size. inches.	No. Size. inches.	No. Size. inches.	No. Size. inches.	No. Size. inches.	No. Size. inches.	No. Size. inches.	No. Size. inches.
FORE & MAIN Shrouds	6 and cap $4\frac{1}{8}$	6 and cap 4	5 and cap $3\frac{3}{4}$	5 and cap $3\frac{1}{2}$	5 and cap $3\frac{1}{4}$	5 3	4 $2\frac{3}{4}$	4 $2\frac{1}{2}$
,, ,, Chain Plates	$1\frac{7}{8}$	$1\frac{7}{8}$	$1\frac{3}{4}$	$1\frac{3}{4}$	$1\frac{5}{8}$	$1\frac{3}{8}$	$1\frac{1}{4}$	$1\frac{1}{4}$
,, ,, Dead-eyes	$10\frac{1}{2}\times6$	10×6	$9\frac{1}{2}\times5\frac{1}{2}$	$9\times5\frac{1}{2}$	$8\frac{1}{2}\times5$	8×5	$7\frac{1}{2}\times4\frac{1}{2}$	$7\times4\frac{1}{2}$
,, ,, Lanyards (hemp)	$5\frac{1}{4}$	5	$4\frac{3}{4}$	$4\frac{1}{2}$	$4\frac{1}{4}$	4	$3\frac{3}{4}$	$3\frac{1}{2}$
,, ,, {Rigging Screws, Diameter at bottom of thread}	$1\frac{5}{8}$	$1\frac{5}{8}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{3}{8}$	$1\frac{1}{4}$	$1\frac{1}{8}$	$1\frac{1}{8}$
,, ,, Rigging Screws, Diameter of Pins	$1\frac{3}{8}$	$1\frac{3}{8}$	$1\frac{3}{8}$	$1\frac{3}{8}$	$1\frac{1}{4}$	$1\frac{1}{8}$	1	1
,, ,, Topmast backstays	3 $4\frac{1}{8}$	3 4	2 $3\frac{3}{4}$	2 $3\frac{1}{2}$	2 $3\frac{1}{4}$	2 3	2 $2\frac{3}{4}$	2 $2\frac{1}{2}$
,, ,, Top-gallant backstays	2 $2\frac{3}{4}$	2 $2\frac{5}{8}$	2 $2\frac{1}{2}$	$2\frac{3}{8}$	$2\frac{1}{4}$	$2\frac{1}{8}$	2	$1\frac{3}{4}$
,, ,, Lower stays	2 $4\frac{1}{8}$	2 4	2 $3\frac{3}{4}$	2 $3\frac{1}{2}$	2 $3\frac{1}{4}$	2 3	2 $2\frac{3}{4}$	2 $2\frac{1}{2}$
,, ,, Topmast stays	2 $4\frac{1}{8}$	2 4	2 $3\frac{3}{4}$	2 $3\frac{1}{2}$	$3\frac{1}{4}$	3	$2\frac{3}{4}$	$2\frac{1}{2}$
,, ,, Top-gallant stays	$2\frac{3}{4}$	$2\frac{5}{8}$	$2\frac{1}{2}$	$2\frac{3}{8}$	$2\frac{1}{4}$	$2\frac{1}{8}$	2	$1\frac{3}{4}$
MIZEN Shrouds	5 and cap $3\frac{1}{4}$	5 3	5 $2\frac{7}{8}$	5 $2\frac{3}{4}$	4 $2\frac{5}{8}$	4 $2\frac{1}{2}$	3 $2\frac{3}{8}$	3 $2\frac{1}{4}$
,, Topmast backstays	3 $3\frac{1}{4}$	3 3	2 $2\frac{7}{8}$	2 $2\frac{3}{4}$	2 $2\frac{5}{8}$	$2\frac{1}{2}$	$2\frac{3}{8}$	$2\frac{1}{4}$
,, Top-gallant backstays	2 $2\frac{1}{8}$	2 2	$1\frac{7}{8}$	$1\frac{3}{4}$	$1\frac{5}{8}$	$1\frac{1}{2}$	$1\frac{3}{8}$	$1\frac{1}{4}$
,, Lower stays	2 $3\frac{1}{4}$	2 3	$2\frac{7}{8}$	$2\frac{3}{4}$	$2\frac{5}{8}$	$2\frac{1}{2}$	$2\frac{3}{8}$	$2\frac{1}{4}$
,, Topmast stays	2 $3\frac{1}{4}$	3	$2\frac{7}{8}$	$2\frac{3}{4}$	$2\frac{5}{8}$	$2\frac{1}{2}$	$2\frac{3}{8}$	$2\frac{1}{4}$
,, Top-gallant stays	$2\frac{1}{8}$	2	$1\frac{7}{8}$	$1\frac{3}{4}$	$1\frac{5}{8}$	$1\frac{1}{2}$	$1\frac{3}{8}$	$1\frac{1}{4}$
BOBSTAY Bar	$3\frac{1}{4}$	3	$2\frac{1}{2}$	$2\frac{1}{4}$	2	2	2	2
,, Pin	$2\frac{1}{4}$	$2\frac{1}{8}$	$1\frac{7}{8}$	$1\frac{5}{8}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$	$1\frac{1}{2}$
,, Chain	$1\frac{10}{16}$	$1\frac{8}{16}$	$1\frac{6}{16}$	$1\frac{5}{16}$	$1\frac{4}{16}$	$1\frac{4}{16}$	$1\frac{4}{16}$	$1\frac{3}{16}$
BOWSPRIT Shrouds (Chain)	2 $\frac{7}{8}$	2 $\frac{13}{16}$	2 $\frac{12}{16}$	$\frac{12}{16}$	$\frac{11}{16}$	$\frac{10}{16}$	$\frac{9}{16}$	$\frac{9}{16}$

1.—The above requirements are intended to apply to vessels in which the dimensions of the masts and yards are such as would not be deemed unusual for vessels of the respective tonnages; where these dimensions are extreme, or in other exceptional cases where deviations from the above sizes are required, rigging plans showing the sizes and arrangements of the several parts should be submitted for the approval of the Committee.

2.—Where four masts are adopted instead of three, the tonnage of the vessel may be reduced one-fifth, and where five masts are adopted, one fourth, in obtaining the sizes of Rigging, &c., from the above table.

3.—Where pole masts are adopted in vessels requiring one cap shroud only, an additional cap shroud is to be fitted, when the number of lower shrouds may be correspondingly reduced.

4.—Where double top-gallant yards are to be adopted, a topmast cap backstay should be fitted in addition.

5.—The steel wire ropes to be guaranteed to withstand the breaking stress given in the Table, and no hemp is to be used in the strands, a hemp core only to be fitted.

6.—A short length of each of the wires composing the rigging will be required, after being galvanized, to withstand a tensile stress equivalent to that set forth in the Table, and the aggregate strength of the wires must not be less than 10 per cent. in excess of that stress.

7.—Each wire will be required to be capable of being twisted around itself not less than eight times, and of being untwisted and straightened without breaking.

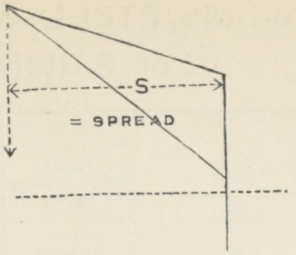
8.—Where it is proposed to adopt iron wire rigging the sizes proposed and the guaranteed tests should be submitted for the consideration of the Committee.

LLOYD'S REGISTER OF SHIPPING, LONDON.—*11th May 1911.*

TABLE 29.

ANCHOR CRANES.

The dimensions of the principal parts of ANCHOR CRANES to be in accordance with the following Table :—



WEIGHT OF ANCHOR INCLUDING STOCK.	SPREAD OF CRANE IN FEET.						
	9	10	11	12	13	14	15
Cwts.	DIAMETER OF MAIN POST AT DECK IN INCHES.						
20	6	6¼	6½	6¾	6¾	7	7¼
25	6½	6¾	7	7¼	7¼	7½	7¾
30	7	7¼	7½	7¾	7¾	8	8¼
35	7¼	7½	7¾	8	8	8¼	8½
40	7½	7¾	8	8¼	8½	8¾	9
45	8	8¼	8½	8¾	9	9¼	9½
50	8¼	8½	8¾	9	9¼	9½	9¾
55	8½	8¾	9	9¼	9½	9¾	10
60	8¾	9	9¼	9½	9¾	10	10¼

CORRESPONDING DIMENSIONS OF MAIN POST, TIE RODS AND JIBS.

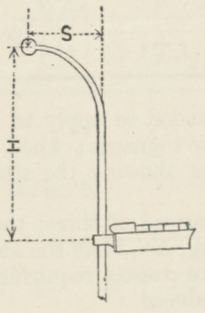
	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.
Diameter of Main Post at deck	6	6½	7	7½	8	8½	9	9½	10	10½
Tie Rod	1¾	1⅞	2	2⅛	2¼	2⅜	2½	2⅝	2¾	2⅞
Jib (Diameter at middle) ...	3	3¼	3½	3¾	4	4¼	4½	4¾	5	5¼

If two Tie rods are fitted, the diameter of each to be ¾th that of the single rod required.

BOATS' DAVITS.

In the cases of boats and davits of ordinary proportions the diameter d of the davit in inches must be obtained by using the formula—

$$d = \sqrt[3]{\frac{L \times B \times D\,(H + 4S)}{C}}$$



where L, B and D are the length, breadth and depth respectively of the boat, H is the height of the davit above its uppermost point of support, and S is the spread of the davit; each of these dimensions being in feet.

The value of the constant term C is to be as follows:—

1. When the davit is to be of wrought iron and of sufficient strength to carry the boat, and its equipment and a sufficient number of men to launch it the value of C is to be 144.

2. When the davit referred to in (1) is to be of wrought ingot steel of from 28 to 32 tons per square inch tensile strength the value of C is to be 174.

3. When the davit is to be of wrought iron and of sufficient strength to safely lower the boat fully equipped and carrying the maximum number of persons for which it is intended, the value of C is to be 82.

4. When the davit referred to in (3) is to be of wrought ingot steel of from 28 to 32 tons per square inch tensile strength the value of C is to be 99.

Boat and anchor davits made of approved weldless rolled or drawn steel tubes will be admitted, provided the scantlings be as required by the following table of equivalent sizes and that the steel of which the davits are made has a tensile strength of not less than 35 tons per square inch with an elongation of not less than 10 per cent. in a length of 8 inches. The davits are to have solid heels and are to be efficiently strengthened in way of the heads and deck supports.

TABLE OF EQUIVALENT SIZES.

Diameter at deck of solid wrought iron davits or of main posts of anchor cranes.	Diameter and thickness of approved weldless drawn steel hollow boat or anchor davits.
Ins.	Ins.
3	4 × 1 4/16
3¼	4½ × 1 4/16
3½	4¾ × 1 4/16
3¾	5¼ × 1 4/16
4	5¼ × 1 5/16
4¼	5¾ × 1 5/16
4½	6 × 1 5/16
4¾	6½ × 1 5/16
5	6½ × 1 6/16
5¼	7 × 1 6/16
5½	7¼ × 1 6/16
5¾	7¾ × 1 6/16
6	7¾ × 1 7/16
6¼	8¼ × 1 7/16
6½	8½ × 1 7/16
6¾	9 × 1 7/16
7	9 × 1 8/16
7¼	9½ × 1 8/16
7½	9¾ × 1 8/16
7¾	10¼ × 1 8/16
8	10¼ × 1 9/16
8¼	10¾ × 1 9/16
8½	11 × 1 9/16

TABLES 30 & 31.

EQUIPMENT

FOR

SAILING VESSELS AND STEAMERS.

CHAINS AND ANCHORS FOR SAILING VESSELS. TABLE 30.

(See Continuation.)

Minimum Weights of Anchors, ex. Stock; Sizes, Lengths and Weights of Chains, and the Proof Strain to which they are to be tested per Chain Cables and Anchor Acts. Also Sizes and Lengths of Towlines, Hawsers and Warps. The Anchors and the links of the Chains to be of unexceptionable form and proportions.

Equipment Numbers for IRON AND STEEL Vessels. See Note (*a*).	Letters for Equipment as inserted in Register Book. Column 8.	GROSS TONNAGE LESS CREW SPACE. See Note †	ANCHORS.									CHAIN CABLES, HAWSERS, &c.						
			NUMBER.			BOWER ANCHORS. (b) (d) Ex. Stock.			STREAM AND KEDGE ANCHORS. (b) (d) Ex. Stock.				STUD-CHAIN CABLES (e) (f) (h).						
			Bowers.	Stream.	Kedge.	Weight.	Test. *	Collective Weight	Stream.	Test. *	Kedge.	Test. *	Length.	Minimum Size.	Proved to Statutory Test.	Breaking Test.	Minimum Weight.		
Above and not exceeding		Above Tons. not exceeding				Cwts.	Tons.	Cwts.	Cwts.	Tons.	Cwts.	Tons.	Fathoms.	Inches.	Tons.	Tons.	Cwts.	qrs.	lbs.
1600 and 2100	*a*	50 and 75	2	1	1	$3\frac{1}{2}$	$5\frac{18}{20}$	7	$\frac{3}{4}$	—	$\frac{1}{2}$	—	120	$\frac{11}{16}$	$8\frac{5}{10}$	$12\frac{3}{4}$	29	0	14
2100 ,, 2500	*b*	75 ,, 100	2	1	1	$4\frac{1}{4}$	$6\frac{12}{20}$	$8\frac{1}{2}$	$1\frac{1}{4}$	$3\frac{13}{20}$	$\frac{1}{2}$	—	120	$\frac{12}{16}$	$10\frac{1}{8}$	$15\frac{1}{8}$	34	2	7
2500 ,, 3000	*c*	100 ,, 125	2	1	1	5	$7\frac{7}{20}$	10	$1\frac{1}{2}$	$3\frac{18}{20}$	$\frac{3}{4}$	—	135	$\frac{13}{16}$	$11\frac{7}{8}$	$17\frac{8}{10}$	45	3	3
3000 ,, 3400	*d*	125 ,, 150	2	1	1	$5\frac{3}{4}$	8	$11\frac{1}{2}$	$1\frac{1}{2}$	$3\frac{18}{20}$	$\frac{3}{4}$	—	165	$\frac{14}{16}$	$13\frac{3}{4}$	$20\frac{5}{8}$	64	1	11
3400 ,, 3900	*e*	150 ,, 175	2	1	1	$6\frac{1}{2}$	$8\frac{15}{20}$	13	2	$4\frac{10}{20}$	1	—	165	$\frac{15}{16}$	$15\frac{8}{10}$	$23\frac{7}{10}$	74	1	26
3900 ,, 4300	*f*	175 ,, 200	2	1	1	$7\frac{1}{4}$	$9\frac{9}{20}$	$14\frac{1}{2}$	$2\frac{1}{4}$	$4\frac{15}{20}$	1	—	165	1	18	27	84	0	17
4300 ,, 4800	*g*	200 ,, 250	3	1	1	$8\frac{1}{4}$	$10\frac{7}{20}$	$23\frac{1}{2}$	$2\frac{1}{2}$	5	$1\frac{1}{4}$	$3\frac{13}{20}$	165	$1\frac{1}{16}$	$20\frac{3}{10}$	$30\frac{4}{10}$	95	1	9
4800 ,, 5300	*h*	250 ,, 300	3	1	1	10	12	$28\frac{1}{2}$	$3\frac{3}{4}$	$6\frac{3}{20}$	$1\frac{3}{4}$	$4\frac{4}{20}$	195	$1\frac{2}{16}$	$22\frac{3}{4}$	$34\frac{1}{8}$	126	1	0
5300 ,, 5900	*i*	300 ,, 350	3	1	1	12	$13\frac{17}{20}$	$34\frac{1}{4}$	4	$6\frac{7}{20}$	2	$4\frac{10}{20}$	195	$1\frac{3}{16}$	$25\frac{3}{8}$	38	141	0	16
5900 ,, 6500	*j*	350 ,, 400	3	1	1	$13\frac{1}{2}$	$15\frac{3}{20}$	$38\frac{1}{2}$	$4\frac{3}{4}$	$7\frac{2}{20}$	$2\frac{1}{2}$	5	210	$1\frac{4}{16}$	$28\frac{1}{8}$	$42\frac{1}{8}$	168	0	0
6500 ,, 7100	*k*	400 ,, 450	3	1	1	$15\frac{1}{4}$	$16\frac{14}{20}$	$43\frac{1}{2}$	$5\frac{1}{4}$	$7\frac{11}{20}$	$2\frac{1}{2}$	5	210	$1\frac{5}{16}$	31	$46\frac{1}{2}$	185	2	12
7100 ,, 7700	*l*	450 ,, 500	3	1	1	17	$18\frac{5}{20}$	$48\frac{1}{2}$	$5\frac{1}{2}$	$7\frac{16}{20}$	$2\frac{3}{4}$	$5\frac{5}{20}$	240	$1\frac{6}{16}$	34	51	232	0	21
7700 ,, 8400	*m*	500 ,, 600	3	1	1	19	$19\frac{17}{20}$	54	$6\frac{1}{2}$	$8\frac{15}{20}$	$3\frac{1}{4}$	$5\frac{14}{20}$	240	$1\frac{7}{16}$	$37\frac{1}{8}$	$55\frac{5}{8}$	254	0	19
8400 ,, 9200	*n*	600 ,, 700	3	1	1	21	$21\frac{12}{20}$	60	$7\frac{1}{4}$	$9\frac{9}{20}$	$3\frac{1}{2}$	$5\frac{18}{20}$	240	$1\frac{8}{16}$	$40\frac{5}{10}$	$58\frac{7}{10}$	276	2	14
9200 ,, 10100	*o*	700 ,, 800	3	1	1	$23\frac{1}{2}$	$23\frac{10}{20}$	67	8	$10\frac{2}{20}$	4	$6\frac{7}{20}$	270	$1\frac{9}{16}$	$43\frac{9}{10}$	$61\frac{4}{10}$	336	0	0
10100 ,, 11100	*p*	800 ,, 900	3	1	1	$25\frac{1}{2}$	$25\frac{3}{20}$	$72\frac{3}{4}$	$8\frac{1}{2}$	$10\frac{12}{20}$	$4\frac{1}{4}$	$6\frac{12}{20}$	270	$1\frac{10}{16}$	$47\frac{5}{10}$	$66\frac{5}{10}$	359	1	9
11100 ,, 12300	*q*	900 ,, 1000	3	1	1	$27\frac{3}{4}$	$26\frac{18}{20}$	79	$8\frac{3}{4}$	$10\frac{17}{20}$	$4\frac{1}{2}$	$6\frac{17}{20}$	270	$1\frac{11}{16}$	$51\frac{1}{4}$	$71\frac{3}{4}$	387	3	4
12300 ,, 13600	*r*	1000 ,, 1200	3	1	1	30	$28\frac{12}{20}$	$85\frac{1}{2}$	$9\frac{1}{2}$	$11\frac{11}{20}$	$4\frac{3}{4}$	$7\frac{2}{20}$	270	$1\frac{12}{16}$	$55\frac{1}{8}$	$77\frac{1}{8}$	416	3	0
13600 ,, 15100	*s*	1200 ,, 1400	3	1	1	32	$30\frac{2}{20}$	$91\frac{1}{4}$	$10\frac{1}{2}$	$12\frac{8}{20}$	$5\frac{1}{4}$	$7\frac{11}{20}$	270	$1\frac{13}{16}$	$59\frac{1}{8}$	$82\frac{3}{4}$	447	2	3
15100 ,, 16800	*t*	1400 ,, 1600	3	1	1	34	$31\frac{12}{20}$	97	$10\frac{3}{4}$	$12\frac{13}{20}$	$5\frac{1}{2}$	$7\frac{16}{20}$	270	$1\frac{14}{16}$	$63\frac{1}{4}$	$88\frac{5}{10}$	478	1	18
16800 ,, 18600	*u*	—	3	1	1	$36\frac{1}{2}$	$33\frac{8}{20}$	104	$11\frac{1}{4}$	$13\frac{2}{20}$	$5\frac{1}{2}$	$7\frac{16}{20}$	270	$1\frac{15}{16}$	$67\frac{5}{10}$	$94\frac{5}{10}$	511	1	14
18600 ,, 20500	*v*	—	3	1	1	38	$34\frac{10}{20}$	$108\frac{1}{4}$	$11\frac{1}{2}$	$13\frac{7}{20}$	$5\frac{3}{4}$	8	270	2	72	$100\frac{8}{10}$	538	3	0
20500 ,, 22700	*w*	—	3	1	1	40	$35\frac{15}{20}$	114	12	$13\frac{17}{20}$	6	$8\frac{5}{20}$	270	$2\frac{1}{16}$	$76\frac{5}{10}$	$107\frac{1}{10}$	573	2	14
22700 ,, 25200	*x*	—	3	1	1	42	$37\frac{2}{20}$	$119\frac{3}{4}$	$13\frac{1}{2}$	$15\frac{3}{20}$	$6\frac{3}{4}$	9	300	$2\frac{3}{16}$	$86\frac{1}{8}$	$120\frac{5}{10}$	717	2	0
25200 ,, 27900	*y*	—	3	1	1	45	$39\frac{5}{20}$	$128\frac{1}{4}$	$15\frac{1}{4}$	$16\frac{14}{20}$	$7\frac{1}{2}$	$9\frac{13}{20}$	300	$2\frac{5}{16}$	$96\frac{1}{4}$	$134\frac{3}{4}$	800	3	14
27900 ,, 30800	*z*	—	3	1	1	48	$41\frac{2}{20}$	137	17	$18\frac{5}{20}$	$8\frac{1}{2}$	$10\frac{12}{20}$	300	$2\frac{6}{16}$	$101\frac{1}{2}$	$142\frac{1}{10}$	844	1	0

N.B.—For Notes to the above Table, see pages 274 and 275.
For Equipment of Trawlers and Tugs, see page 274.

CHAINS AND ANCHORS FOR SAILING VESSELS. TABLE 30.

(Concluded.)

Minimum Weights of Anchors, ex. Stock; Sizes, Lengths and Weights of Chains, and the Proof Strain to which they are to be tested per Chain Cables and Anchors Acts. Also Sizes and Lengths of Towlines, Hawsers and Warps. The Anchors and the links of the Chains to be of unexceptionable form and proportions.

Equipment Numbers for IRON AND STEEL Vessels. See Note (*a*).		Letters for Equipment as inserted in Register Book. Column 8.	GROSS TONNAGE LESS CREW SPACE. See Note †		CHAIN CABLES, HAWSERS, &c.															
					STREAM, CHAIN OR STEEL WIRE (*e*) (*g*).									TOWLINE: HEMP OR STEEL WIRE (*i*)				HAWSERS AND WARPS 90 fathoms of each.	
					Length.	CHAIN.						STEEL WIRE (*i*)		Length.	HEMP.	STEEL WIRE.			
						Size.	Minimum Weight.					Size.	Breaking Test.		Size.	Size.	Breaking Test.		
							Stud Link.			Short Link.									
Above	not exceeding		Tons. Above	not exceeding	Fathoms.	Inches.	Cwts.	qrs.	lbs.	Cwts.	qrs.	lbs.	Inches.	Tons.	Fathoms.	Inches.	Inches.	Tons.	Ins.	Ins.
1600 and	2100	*a*	50 and	75	45	$\frac{7}{16}$	5	1	0	5	3	0	—	—	75	5	$1\frac{3}{4}$	$5\frac{1}{2}$	3	—
2100 ,,	2500	*b*	75 ,,	100	45	$\frac{8}{16}$	6	2	0	7	1	0	—	—	75	$5\frac{1}{2}$	2	7	3	—
2500 ,,	3000	*c*	100 ,,	125	45	$\frac{8}{16}$	6	2	0	7	1	0	—	—	75	$5\frac{1}{2}$	2	7	3	—
3000 ,,	3400	*d*	125 ,,	150	45	$\frac{8}{16}$	6	2	0	7	1	0	—	—	75	6	$2\frac{1}{4}$	$9\frac{1}{2}$	$3\frac{1}{2}$	—
3400 ,,	3900	*e*	150 ,,	175	45	$\frac{9}{16}$	8	0	0	8	3	0	2	7	75	$6\frac{1}{2}$	$2\frac{1}{4}$	$9\frac{1}{2}$	4	—
3900 ,,	4300	*f*	175 ,,	200	45	$\frac{9}{16}$	8	0	0	8	3	0	2	7	75	$6\frac{1}{2}$	$2\frac{1}{4}$	$9\frac{1}{2}$	4	—
4300 ,,	4800	*g*	200 ,,	250	45	$\frac{10}{16}$	9	3	0	10	2	0	$2\frac{1}{4}$	$9\frac{1}{2}$	75	7	$2\frac{1}{2}$	$12\frac{1}{2}$	4	—
4800 ,,	5300	*h*	250 ,,	300	45	$\frac{10}{16}$	9	3	0	10	2	0	$2\frac{1}{4}$	$9\frac{1}{2}$	75	$7\frac{1}{2}$	$2\frac{1}{2}$	$12\frac{1}{2}$	5	—
5300 ,,	5900	*i*	300 ,,	350	60	$\frac{11}{16}$	14	2	7	15	3	7	$2\frac{3}{4}$	$15\frac{1}{2}$	75	8	$2\frac{3}{4}$	$15\frac{1}{2}$	$5\frac{1}{2}$	—
5900 ,,	6500	*j*	350 ,,	400	60	$\frac{11}{16}$	14	2	7	15	3	7	$2\frac{3}{4}$	$15\frac{1}{2}$	75	8	$2\frac{3}{4}$	$15\frac{1}{2}$	$5\frac{1}{2}$	—
6500 ,,	7100	*k*	400 ,,	450	60	$\frac{12}{16}$	17	1	3	18	3	3	$2\frac{3}{4}$	$15\frac{1}{2}$	75	$8\frac{1}{2}$	$2\frac{3}{4}$	$15\frac{1}{2}$	6	—
7100 ,,	7700	*l*	450 ,,	500	60	$\frac{12}{16}$	17	1	3	18	3	3	$2\frac{3}{4}$	$15\frac{1}{2}$	75	9	3	18	$6\frac{1}{2}$	—
7700 ,,	8400	*m*	500 ,,	600	60	$\frac{13}{16}$	20	1	11	22	0	11	3	18	75	$9\frac{1}{2}$	$3\frac{1}{4}$	22	7	—
8400 ,,	9200	*n*	600 ,,	700	60	$\frac{13}{16}$	20	1	11	22	0	11	3	18	90	10	$3\frac{1}{4}$	22	7	4
9200 ,,	10100	*o*	700 ,,	800	60	$\frac{14}{16}$	23	1	17	25	1	17	$3\frac{1}{4}$	22	90	10	$3\frac{1}{4}$	22	8	5
10100 ,,	11100	*p*	800 ,,	900	75	$\frac{14}{16}$	29	1	0	31	2	0	$3\frac{1}{4}$	22	90	10	$3\frac{1}{4}$	22	8	5
11100 ,,	12300	*q*	900 ,,	1000	75	$\frac{15}{16}$	33	3	11	36	1	11	$3\frac{1}{2}$	26	90	$10\frac{1}{2}$	$3\frac{1}{4}$	22	9	$5\frac{1}{2}$
12300 ,,	13600	*r*	1000 ,,	1200	75	$\frac{15}{16}$	33	3	11	36	1	11	$3\frac{1}{2}$	26	90	$10\frac{1}{2}$	$3\frac{1}{4}$	22	9	$5\frac{1}{2}$
13600 ,,	15100	*s*	1200 ,,	1400	75	1	38	1	0	41	1	0	$3\frac{3}{4}$	29	90	11	$3\frac{1}{2}$	26	$9\frac{1}{2}$	6
15100 ,,	16800	*t*	1400 ,,	1600	75	1	38	1	0	41	1	0	$3\frac{3}{4}$	29	90	11	$3\frac{1}{2}$	26	10	6
16800 ,,	18600	*u*	—		75	$1\frac{1}{16}$	43	1	9	46	1	9	4	33	90	11	$3\frac{1}{2}$	26	$10\frac{1}{2}$	$6\frac{1}{2}$
18600 ,,	20500	*v*	—		75	$1\frac{1}{16}$	43	1	9	46	1	9	4	33	90	12	4	33	11	7
20500 ,,	22700	*w*	—		100	$1\frac{2}{16}$	64	2	27	69	2	3	$4\frac{1}{4}$	35	90	12	4	33	11	7
22700 ,,	25200	*x*	—		120	$1\frac{2}{16}$	77	2	21	83	1	21	$4\frac{1}{4}$	35	90	13	$4\frac{1}{2}$	39	12	8
25200 ,,	27900	*y*	—		120	$1\frac{3}{16}$	86	3	12	93	0	12	$4\frac{1}{2}$	39	90	13	$4\frac{1}{2}$	39	12	8
27900 ,,	30800	*z*	—		120	$1\frac{4}{16}$	96	0	0	103	0	0	$4\frac{3}{4}$	47	120	14	$4\frac{3}{4}$	47	13	9

N.B.—For Notes to the above Table, see pages 274 and 275.

For Equipment of Trawlers and Tugs, see page 274.

LLOYD'S REGISTER OF SHIPPING, LONDON.—*11th December, 1913.*

CHAINS AND ANCHORS FOR STEAM VESSELS.

TABLE 31.

(See Continuation.)

Minimum Weights of Anchors, ex. Stock and Stockless; Sizes, Lengths and Weights of Chains, and the Proof Strain to which they are to be tested per Chain Cables and Anchors Act. Also Sizes and Lengths of Towlines, Hawsers and Warps. The Anchors and the links of the Chains to be of unexceptionable form and proportions.

Equipment Numbers for IRON AND STEEL Vessels. See Note (a)		Letters for Equipment as inserted in Register Book. Column 7.	GROSS TONNAGE LESS CREW SPACE. See Note † Tons.			ANCHORS.									CHAIN CABLES, HAWSERS, &c.					
						NUMBER.			BOWER ANCHORS (b) (d)						STREAM AND KEDGE ANCHORS (b) (c) (d)				STUD-CHAIN CABLES (e) (f) (h)				
									Ex. Stock.			Stockless.			Ex. Stock.								
						Bowers	Stream	Kedge	Weight.	Test.*	Collective Wght.	Weight.	Test.*	Collective Wght.	Stream.	Test.*	Kdge.	Test.*	Lgth.	Minimum Size.	Proved to Statutory Test.	Breaking Test.	Minimum Weight.
Above	not exceeding		Above	not exceeding					Cwts.	Tons.	Cwts.	Cwts.	Tons.	Cwts.	Cwts.	Tons.	Cwts.	Tons.	Fms.	Ins.	Tons.	Tons.	Cwts. q. lbs.
2400 and	3000	*a*	80 and	115		2	1	1	3½	5 18/20	7	4½	6 17/20	8¾	¾	—	½	—	120	1 1/16	8 5/10	12¾	29 0 14
3000 ,,	3600	*b*	115 ,,	150		2	1	1	4¼	6 12/20	8½	5¼	7 11/20	10½	1¼	3 13/20	½	—	120	1 2/16	10⅛	15⅛	34 2 7
3600 ,,	4200	*c*	150 ,,	185		2	1	1	5	7 7/20	10	6¼	8 10/20	12½	1¾	4 4/20	¾	—	135	1 3/16	11⅞	17 8/10	45 3 3
4200 ,,	4800	*d*	185 ,,	230		2	1	1	5¾	8	11½	7¼	9 9/20	14¼	2¼	4 15/20	¾	—	165	1 4/16	13¾	20⅝	64 1 11
4800 ,,	5400	*e*	230 ,,	275		2	1	1	6½	8 15/20	13	8¼	10 7/20	16¼	2¾	5 5/20	1	—	165	1 5/16	15 8/10	23 7/10	74 1 26
5400 ,,	6000	*f*	275 ,,	325		2	1	1	7¼	9 9/20	14½	9	11 2/20	18	3	5 10/20	1¼	3 13/20	165	1	18	27	84 0 17
6000 ,,	6700	*g*	325 ,,	380		3	1	1	8¼	10 7/20	23½	10¼	12 4/20	29¼	3½	5 18/20	1½	3 18/20	165	1 1/16	20 3/10	30 4/10	95 1 9
6700 ,,	7400	*h*	380 ,,	435		3	1	1	10	12	28½	12½	14 6/20	35½	4	6 7/20	1¾	4 4/20	195	1 2/16	22¾	34⅛	126 1 0
7400 ,,	8100	*i*	435 ,,	500		3	1	1	11¾	13 12/20	33½	14½	16 1/20	41¾	4¼	6 12/20	2	4 10/20	195	1 3/16	25⅜	38	141 0 16
8100 ,,	8900	*j*	500 ,,	580		3	1	1	13½	15 3/20	38½	16¾	18	48	4¾	7 2/20	2¼	4 15/20	210	1 4/16	28⅛	42⅛	168 0 0
8900 ,,	9700	*k*	580 ,,	680		3	1	1	15¼	16 14/20	43½	19	19 17/20	54¼	5¼	7 11/20	2½	5	210	1 5/16	31	46½	185 2 12
9700 ,,	10600	*l*	680 ,,	790		3	1	1	17	18 5/20	48½	21¼	21 16/20	60½	5¾	8	2¾	5 5/20	210	1 6/16	34	51	203 0 18
10600 ,,	11600	*m*	790 ,,	910		3	1	1	18¾	19 13/20	53½	23¼	23 6/20	66¾	6	8 5/20	3	5 10/20	210	1 7/16	37⅛	55⅝	222 1 17
11600 ,,	12700	*n*	910 ,,	1040		3	1	1	20½	21 3/20	58½	25½	25 3/20	73	6½	8 15/20	3½	5 18/20	210	1 8/16	40 5/10	58 7/10	242 0 5
12700 ,,	13900	*o*	1040 ,,	1200		3	1	1	22½	22 15/20	64	28	27 2/20	80	7	9 5/20	4	6 7/20	240	1 9/16	43 9/10	61 4/10	298 2 19
13900 ,,	15200	*p*	1200 ,,	1380		3	1	1	24½	24 6/20	69½	30½	29	87	7¾	9 18/20	4¼	6 12/20	240	1 10/16	47 5/10	66 5/10	319 1 17
15200 ,,	16700	*q*	1380 ,,	1580		3	1		26½	26	75	33	30 17/20	94	8½	10 12/20	—	—	240	1 11/16	51¼	71¾	344 2 22
16700 ,,	18500	*r*	1580 ,,	1820		3	1		28½	27 10/20	81	35½	32 15/20	101	9¼	11 6/20	—	—	240	1 12/16	55⅛	77⅛	370 1 22
18500 ,,	20600	*s*		—		3	1		31	29 7/20	88	38¾	34 19/20	110	10	12	—	—	240	1 13/16	59⅛	82¾	397 3 6
20600 ,,	22700	*t*		—		3	1		33½	31 5/20	95½	42	37 2/20	119½	11	12 17/20	—	—	240	1 14/16	63¼	88 5/10	425 1 0
22700 ,,	25000	*u*		—		3	1		36	33 2/20	103	45	39 5/20	128	12	13 17/20	—	—	270	1 15/16	67 5/10	94 5/10	511 1 14
25000 ,,	27300	*v*		—		3	1		39	35 2/20	111	48¾	41 11/20	139	13	14 15/20	—	—	270	2	72	100 8/10	538 3 0
27300 ,,	29700	*w*		—		3	1		42	37 2/20	119½	52½	43 18/20	149½	14	15 12/20	—	—	270	2 1/16	76 5/10	107 1/10	573 2 14
29700 ,,	32200	*x*		—		3	1		45	39 5/20	128	56¼	46 3/20	160	15	16 10/20	—	—	270	2 2/16	81¼	113¾	608 2 14
32200 ,,	34800	*y*		—		3	1		48	41 2/20	136½	60	48 7/20	170½	16¼	17 11/20	—	—	270	2 3/16	86⅛	120 5/10	645 3 0
34800 ,,	37600	*z*		—		3	1		51	43	145½	63¾	50 7/20	182	17½	18 12/20	—	—	270	2 4/16	91⅛	127 5/10	682 1 11
37600 ,,	40400	*a*†		—		3	1		54½	45 1/20	155½	68	52 12/20	194½	19	19 17/20	—	—	270	2 5/16	96¼	134¾	720 3 4
40400 ,,	43200	*b*†		—		3	1		58	47 5/20	165½	72½	55	207	20½	21 3/20	—	—	300	2 6/16	101 5/10	142 1/10	844 1 0
43200 ,,	46000	*c*†		—		3	1		61½	49 3/20	175½	77	57 5/20	219½	22	22 7/20	—	—	300	2 7/16	106 9/10	149⅝	890 1 4
46000 ,,	48800	*d*†		—		3	1		65	51	185½	81¼	59 2/20	232	23½	23 10/20	—	—	300	2 8/16	112 5/10	157 5/10	940 0 0
48800 ,,	51600	*e*†		—		3	1		68½	52 18/20	195½	85½	61 5/20	244½	25	24 15/20	—	—	300	2 9/16	116 7/10	163⅜	989 0 0
51600 ,,	54600	*f*†		—		3	1		72	54 15/20	206	90	63 5/20	257½	26½	26	—	—	300	2 10/16	120 9/10	169¼	1040 0 0
54600 ,,	57600	*g*†		—		3	1		76	56 15/20	217	95	65 7/20	271	28	27 2/20	—	—	330	2 11/16	125 1/10	175⅛	1200 0 0
57600 ,,	60600	*h*†		—		3	1		80	58 10/20	228	100	67 5/20	285	29½	28 5/20	—	—	330	2 12/16	129 3/10	181	1258 0 0
60600 ,,	63800	*i*†		—		3	1		83½	60 5/20	238	104½	68 19/20	298	31	29 7/20	—	—	330	2 13/16	133¾	186¾	1317 0 0
63800 ,,	67000	*j*†		—		3	1		87	61 17/20	248	109	70 12/20	311	32½	30 10/20	—	—	330	2 14/16	137 6/10	192⅝	1378 0 0
67000 ,,	70200	*k*†		—		3	1		91	63 12/20	259	113½	72 6/20	324	34	31 12/20	—	—	330	2 15/16	141 7/10	198⅜	1440 0 0
70200 ,,	73400	*l*†		—		3	1		94½	65 3/20	269	118	74	336	35½	32 15/20	—	—	330	3	145 8/10	204 1/10	1503 0 0
73400 ,,	76800	*m*†		—		3	1		98	66 10/20	279	122½	75 10/20	349	37¼	33 18/20	—	—	330	3 1/16	149 8/10	209 7/10	1568 0 0
76800 ,,	80200	*n*†		—		3	1		101½	67 16/20	290	127	76 18/20	362	39	35 2/20	—	—	330	3 2/16	153¾	215¼	1634 0 0
80200 ,,	83800	*o*†		—		3	1		105½	69 6/20	301	132	78 10/20	376	40¾	36 6/20	—	—	330	3 3/16	157 7/10	220¾	1701 0 0
83800 ,,	87600	*p*†		—		3	1		109½	70 16/20	312	137	80 1/20	390	42½	37 10/20	—	—	330	3 4/16	161 6/10	226 2/10	1769 0 0
87600 ,,	91600	*q*†		—		3	1		113½	72 6/20	324	142	81 12/20	404	44¼	38 15/20	—	—	330	3 5/16	165 4/10	231 5/10	1839 0 0
91600 ,,	95800	*r*†		—		3	1		118	74	336	147½	83 6/20	420	46	39 17/20	—	—	330	3 6/16	169⅛	236¾	1910 0 0
95800 ,,	100200	*s*†		—		3	1		122½	75 10/20	349	153	85	436	47¾	40 19/20	—	—	330	3 7/16	172¾	241 8/10	1983 0 0
100200 ,,	105000	*t*†		—		3	1		127	76 18/20	362	159	86 10/20	452	49½	42 1/20	—	—	330	3 8/16	176 4/10	246 9/10	2057 0 0

N.B.—For Notes to the above Table, see pages 274 and 275.

For Equipment of Trawlers and Tugs, see page 274.

CHAINS AND ANCHORS FOR STEAM VESSELS. TABLE 31. *(Concluded.)*

Minimum Weights of Anchors, ex. Stock and Stockless; Sizes, Lengths and Weights of Chains, and the Proof Strain to which they are to be tested per Chain Cables and Anchors Act. Also Sizes and Lengths of Towlines, Hawsers and Warps. The Anchors and the links of the Chains to be of unexceptionable form and proportions.

Equipment Numbers for IRON AND STEEL Vessels. See Note (a)		Letters for Equipment, as inserted in Register Book, Column 7.	GROSS TONNAGE LESS CREW SPACE. See Note † Tons.		CHAIN CABLES, HAWSERS, &c.															
					STREAM, CHAIN or STEEL WIRE (e) (g)									TOWLINE: HEMP OR STEEL WIRE (i)				HAWSERS AND WARPS.		
					CHAIN.						STEEL WIRE (i)			HEMP.	STEEL WIRE.					
					Length.	Size.	Minimum Weight. Stud Link.			Minimum Weight. Short Link.			Size.	Breaking Test.	Length.	Size.	Size.	Breaking Test.	Size of each.	Size of each.	Length of each.
							Cwts.	qrs.	lbs.	Cwts.	qrs.	lbs.									
Above	not exceeding		Above	not exceeding	Fthms.	Inches.							Ins.	Tons.	Fathms.	Ins.	Ins.	Tons.	Ins.	Ins.	Fathms.
2400 and	3000	*a*	80 and	115	45	$\frac{8}{16}$	6	2	0	7	1	0	—	—	75	$5\frac{1}{2}$	2	7	3	—	90
3000 ,,	3600	*b*	115 ,,	150	45	$\frac{9}{16}$	8	0	0	8	3	0	2	7	75	6	$2\frac{1}{4}$	$9\frac{1}{2}$	4	—	90
3600 ,,	4200	*c*	150 ,,	185	45	$\frac{9}{16}$	8	0	0	8	3	0	2	7	75	6	$2\frac{1}{4}$	$9\frac{1}{2}$	4	—	90
4200 ,,	4800	*d*	185 ,,	230	45	$\frac{10}{16}$	9	3	0	10	2	0	$2\frac{1}{4}$	$9\frac{1}{2}$	75	$6\frac{1}{2}$	$2\frac{1}{4}$	$9\frac{1}{2}$	4	—	90
4800 ,,	5400	*e*	230 ,,	275	45	$\frac{10}{16}$	9	3	0	10	2	0	$2\frac{1}{4}$	$9\frac{1}{2}$	75	7	$2\frac{1}{2}$	$12\frac{1}{2}$	5	—	90
5400 ,,	6000	*f*	275 ,,	325	45	$\frac{11}{16}$	10	3	19	11	3	19	$2\frac{3}{4}$	$15\frac{1}{2}$	75	$7\frac{1}{2}$	$2\frac{1}{2}$	$12\frac{1}{2}$	$5\frac{1}{2}$	—	90
6000 ,,	6700	*g*	325 ,,	380	60	$\frac{11}{16}$	14	2	7	15	3	7	$2\frac{3}{4}$	$15\frac{1}{2}$	75	$7\frac{1}{2}$	$2\frac{1}{2}$	$12\frac{1}{2}$	$5\frac{1}{2}$	—	90
6700 ,,	7400	*h*	380 ,,	435	60	$\frac{12}{16}$	17	1	3	18	3	3	$2\frac{3}{4}$	$15\frac{1}{2}$	75	8	$2\frac{3}{4}$	$15\frac{1}{2}$	6	—	90
7400 ,,	8100	*i*	435 ,,	500	60	$\frac{13}{16}$	20	1	11	22	0	11	3	18	75	$8\frac{1}{2}$	$2\frac{3}{4}$	$15\frac{1}{2}$	6	—	90
8100 ,,	8900	*j*	500 ,,	580	60	$\frac{13}{16}$	20	1	11	22	0	11	3	18	75	$8\frac{1}{2}$	$2\frac{3}{4}$	$15\frac{1}{2}$	6	4	90
8900 ,,	9700	*k*	580 ,,	680	60	$\frac{14}{16}$	23	1	17	25	1	17	$3\frac{1}{4}$	22	90	9	3	18	6	5	90
9700 ,,	10600	*l*	680 ,,	790	60	$\frac{14}{16}$	23	1	17	25	1	17	$3\frac{1}{4}$	22	90	9	3	18	6	5	90
10600 ,,	11600	*m*	790 ,,	910	60	$\frac{15}{16}$	27	0	9	29	0	9	$3\frac{1}{2}$	26	90	$9\frac{1}{2}$	$3\frac{1}{4}$	22	6	5	90
11600 ,,	12700	*n*	910 ,,	1040	75	$\frac{15}{16}$	33	3	11	36	1	11	$3\frac{1}{2}$	26	90	10	$3\frac{1}{4}$	22	6	5	90
12700 ,,	13900	*o*	1040 ,,	1200	75	1	38	1	0	41	1	0	$3\frac{3}{4}$	29	90	10	$3\frac{1}{4}$	22	6	5	90
13900 ,,	15200	*p*	1200 ,,	1380	75	1	38	1	0	41	1	0	$3\frac{3}{4}$	29	90	10	$3\frac{1}{4}$	22	2 of 6	2 of 5	90
15200 ,,	16700	*q*	1380 ,,	1580	75	$1\frac{1}{16}$	43	1	9	46	1	9	4	33	90	11	$3\frac{1}{2}$	26	2 of 6	2 of 5	90
16700 ,,	18500	*r*	1580 ,,	1820	75	$1\frac{1}{16}$	43	1	9	46	1	9	4	33	90	11	$3\frac{1}{2}$	26	2 of 6	2 of 5	90
18500 ,,	20600	*s*	—		75	$1\frac{2}{16}$	48	2	6	52	0	6	$4\frac{1}{4}$	35	90	12	4	33	2 of 7	2 of 6	90
20600 ,,	22700	*t*	—		75	$1\frac{2}{16}$	48	2	6	52	0	6	$4\frac{1}{4}$	35	100	12	4	33	2 of 7	2 of 6	90
22700 ,,	25000	*u*	—		90	$1\frac{2}{16}$	58	1	2	62	1	2	$4\frac{1}{4}$	35	100	12	4	33	2 of 7	2 of 6	90
25000 ,,	27300	*v*	—		90	$1\frac{3}{16}$	65	0	16	69	2	16	$4\frac{1}{2}$	39	120	12	4	33	2 of 7	2 of 7	90
27300 ,,	29700	*w*	—		90	$1\frac{3}{16}$	65	0	16	69	2	16	$4\frac{1}{2}$	39	120	13	$4\frac{1}{2}$	39	2 of 7	2 of 7	90
29700 ,,	32200	*x*	—		90	$1\frac{3}{16}$	65	0	16	69	2	16	$4\frac{1}{2}$	39	120	13	$4\frac{1}{2}$	39	2 of 7	2 of 7	90
32200 ,,	34800	*y*	—		90	$1\frac{4}{16}$	72	0	0	77	0	0	$4\frac{3}{4}$	47	120	14	$4\frac{3}{4}$	47	2 of 8	2 of 7	90
34800 ,,	37600	*z*	—		90	$1\frac{4}{16}$	72	0	0	77	0	0	$4\frac{3}{4}$	47	120	14	5	59	2 of 8	2 of 7	90
37600 ,,	40400	*a*†	—		90	$1\frac{5}{16}$	79	2	5	85	0	5	5	59	120	15	$5\frac{1}{4}$	65	2 of 8	2 of 7	90
40400 ,,	43200	*b*†	—		120	$1\frac{5}{16}$	106	0	7	113	1	7	5	59	130	15	$5\frac{1}{2}$	71	2 of 8	2 of 8	100
43200 ,,	46000	*c*†	—		120	$1\frac{5}{16}$	106	0	7	113	1	7	5	59	130	15	$5\frac{3}{4}$	78	2 of 8	2 of 8	100
46000 ,,	48800	*d*†	—		120	$1\frac{6}{16}$	116	0	10	124	0	10	$5\frac{1}{4}$	65	130	16	6	85	2 of 8	2 of 8	100
48800 ,,	51600	*e*†	—		120	$1\frac{6}{16}$	116	0	10	124	0	10	$5\frac{1}{4}$	65	130	16	6	85	2 of 8	2 of 8	100
51600 ,,	54600	*f*†	—		120	$1\frac{7}{16}$	126	3	0	135	2	0	$5\frac{1}{2}$	71	130	16	6	85	2 of 8	2 of 8	100
54600 ,,	57600	*g*†	—		120	$1\frac{8}{16}$	138	1	0	146	2	0	6	85	130	17	7	113	2 of 8	2 of 8	100
57600 ,,	60600	*h*†	—		120	$1\frac{8}{16}$	138	1	0	146	2	0	6	85	130	—	7	113	2 of 8	2 of 8	120
60600 ,,	63800	*i*†	—		120	$1\frac{9}{16}$	149	1	0	159	0	0	6	85	130	—	7	113	2 of 8	2 of 8	120
63800 ,,	67000	*j*†	—		120	$1\frac{10}{16}$	159	3	0	171	2	0	6	85	130	—	7	113	2 of 8	2 of 8	120
67000 ,,	70200	*k*†	—		150	$1\frac{11}{16}$	215	2	0	231	2	0	$6\frac{1}{2}$	100	140	—	$7\frac{1}{2}$	128	3 of 8	2 of 8	120
70200 ,,	73400	*l*†	—		150	$1\frac{12}{16}$	231	2	0	249	2	0	$6\frac{1}{2}$	100	140	—	$7\frac{1}{2}$	128	3 of 8	2 of 8	120
73400 ,,	76800	*m*†	—		150	$1\frac{13}{16}$	248	2	0	268	2	0	$6\frac{1}{2}$	100	140	—	$7\frac{1}{2}$	128	3 of 8	2 of 8	120
76800 ,,	80200	*n*†	—		150	$1\frac{13}{16}$	248	2	0	268	2	0	$6\frac{1}{2}$	100	140	—	$7\frac{1}{2}$	128	3 of 8	3 of 8	120
80200 ,,	83800	*o*†	—		150	$1\frac{14}{16}$	265	3	0	288	0	0	7	113	140	—	$7\frac{1}{2}$	128	3 of 8	3 of 8	120
83800 ,,	87600	*p*†	—		150	$1\frac{14}{16}$	265	3	0	288	0	0	7	113	140	—	$7\frac{1}{2}$	128	3 of 8	3 of 8	120
87600 ,,	91600	*q*†	—		150	$1\frac{15}{16}$	284	0	0	309	0	0	7	113	150	—	8	149	3 of 8	3 of 8	120
91600 ,,	95800	*r*†	—		150	$1\frac{15}{16}$	284	0	0	309	0	0	7	113	150	—	8	149	3 of 8	3 of 8	120
95800 ,,	100200	*s*†	—		150	2	299	1	0	330	0	0	$7\frac{1}{2}$	128	150	—	8	149	3 of 8	3 of 8	120
100200 ,,	105000	*t*†	—		150	2	299	1	0	330	0	0	$7\frac{1}{2}$	128	150	—	8	149	3 of 8	3 of 8	120

N.B.—For Notes to the above Table, see pages 274 and 275.

For Equipment of Trawlers and Tugs, see page 274.

Equipment for SAILING AND STEAM TRAWLERS AND TUGS.†

REGISTERED U.D. TONNAGE. Sailing Trawlers.		REGISTERED U.D. TONNAGE. Steam Trawlers and Tugs.†		LONGITUDINAL NUMBER FOR IRON AND STEEL STEAM TRAWLERS AND TUGS.†		ANCHORS. No.	ANCHORS. Cwts. ex. Stock. 1st Bower.	ANCHORS. Cwts. ex. Stock. 2nd Bower.	ANCHORS. Cwts. Stockless. For Steamers only. 1st Bower.	ANCHORS. Cwts. Stockless. For Steamers only. 2nd Bower.	ANCHORS. Cwts. ex. Stock. Kedge.	CHAIN (e) (h). Length.	CHAIN (e) (h). Diameter	CHAIN (e) (h). Minimum Weight. Stud Link.			CHAIN (e) (h). Minimum Weight. Short Link.			HAWSERS. Length.	HAWSERS. Size.	WARPS. Length.	WARPS. Size.
Above	not exceeding	Above	not exceeding	Above	not exceeding							Fathms.	Ins.	Cwts.	qrs.	lbs.	Cwts.	qrs.	lbs.	Fathms.	Ins.	Fathms.	Ins.
50 and	65	65 and	80	1980 and	2250	3	3	3	$3\frac{3}{4}$	$3\frac{3}{4}$	$1\frac{3}{4}$	60	$\frac{1}{16}$	17	1	3	18	3	3	60	5	60	$2\frac{1}{2}$
65 ,,	80	80 ,,	100	2250 ,,	2620	3	$3\frac{1}{2}$	$3\frac{1}{2}$	$4\frac{1}{2}$	$4\frac{1}{2}$	2	60	$\frac{3}{16}$	20	1	11	22	0	11	60	$5\frac{1}{2}$	60	3
80 ,,	100	100 ,,	120	2620 ,,	2950	3	4	4	5	5	$2\frac{1}{4}$	60	$\frac{4}{16}$	23	1	17	25	1	17	60	$5\frac{1}{2}$	60	3
100 ,,	120	120 ,,	140	2950 ,,	3230	3	$4\frac{1}{4}$	4	$5\frac{1}{4}$	5	$2\frac{1}{2}$	60	$\frac{4}{16}$	23	1	17	25	1	17	60	$5\frac{1}{2}$	60	$3\frac{1}{2}$
120 ,,	140	140 ,,	160	3230 ,,	3510	3	$4\frac{1}{2}$	4	$5\frac{1}{2}$	5	$2\frac{1}{2}$	75	$\frac{5}{16}$	33	3	11	36	1	11	60	$5\frac{1}{2}$	60	$3\frac{1}{2}$
—		—		3510 ,,	3790	3	$4\frac{3}{4}$	$4\frac{1}{4}$	6	$5\frac{1}{4}$	$2\frac{1}{2}$	90	$\frac{5}{16}$	40	2	13	43	2	13	60	$5\frac{1}{2}$	60	4
—		—		3790 ,,	4040	3	5	$4\frac{1}{2}$	$6\frac{1}{4}$	$5\frac{1}{2}$	$2\frac{1}{2}$	90	1	45	3	17	49	2	0	60	$5\frac{1}{2}$	60	4
—		—		4040 ,,	4290	3	$5\frac{1}{4}$	$4\frac{3}{4}$	$6\frac{1}{2}$	6	$2\frac{1}{2}$	90	1	45	3	17	49	2	0	60	6	60	$4\frac{1}{2}$
—		—		4290 ,,	4530	3	$5\frac{1}{2}$	5	7	$6\frac{1}{4}$	$2\frac{3}{4}$	105	$1\frac{1}{16}$	60	2	18	64	3	12	60	6	60	$4\frac{1}{2}$
—		—		4530 ,,	4770	3	$5\frac{3}{4}$	$5\frac{1}{4}$	$7\frac{1}{4}$	$6\frac{1}{2}$	3	105	$1\frac{1}{16}$	60	2	18	64	3	12	60	6	60	5
—		—		4770 ,,	5010	3	6	$5\frac{1}{2}$	$7\frac{1}{2}$	7	3	120	$1\frac{2}{16}$	77	2	21	83	1	21	60	6	60	5
—		—		5010 ,,	5260	3	$6\frac{1}{4}$	$5\frac{3}{4}$	8	$7\frac{1}{4}$	$3\frac{1}{4}$	120	$1\frac{2}{16}$	77	2	21	83	1	21	60	6	60	5
—		—		5260 ,,	5570	3	$6\frac{1}{2}$	6	$8\frac{1}{4}$	$7\frac{1}{2}$	$3\frac{1}{4}$	120	$1\frac{2}{16}$	77	2	21	83	1	21	60	6	60	5
—		—		5570 ,,	5900	3	$6\frac{3}{4}$	$6\frac{1}{4}$	$8\frac{1}{2}$	8	$3\frac{1}{2}$	120	$1\frac{3}{16}$	86	3	12	93	0	12	60	7	60	5

† The equipment for Tug Steamers of a larger size than the Trawlers provided for by the above Table shall be the same as for ordinary seagoing vessels.

The Anchors and Chains to be tested at a Public Testing Machine in accordance with the statutory tests.

✡ The tests of Anchors in this Table are approximate tests ; or as near as can be expressed in tons and aliquot part of tons.

(a) By Section 50 of the Rules for the Building and Classification of Steel Vessels, it is provided that the equipment is to be regulated by the number produced by the sum of the measurements in feet of the greatest moulded breadth of the vessel and the depth from the upper part of keel to the top of the upper deck beams at side at the middle of the length multiplied by the length of the vessel. In vessels having cruiser sterns, the length determining the Equipment number is to be measured as required by Section 2 for vessels of this type. In awning or shelter deck and part awning deck vessels the measurement of depth defined above is to be taken to the deck next below the awning or shelter deck, provided the height between the decks does not exceed 8 feet. If the 'tween deck height exceeds 8 feet the measurement is to be taken to a point 8 feet below the awning or shelter deck. In turret deck vessels to the normal beam line at base of turret.

For a sailing vessel with a poop, bridge, top-gallant forecastle, or a raised quarter-deck, the equipment number is to be increased *one-fifteenth* beyond that which it would be if she were flush-decked.

For a steam vessel having erections on deck, the number obtained by the first clause of this paragraph is to be increased as follows :—

For a raised quarter deck, add the product of the height and length in feet of the erection.

For an awning or shelter deck, part awning deck, poop, bridge or forecastle add three-fourths the product of the height and length in feet of each erection, eight feet being taken as the maximum height for awning, or shelter deck, or part awning deck erections.

For deck houses or other erections not extending to the side, but exceeding either in length or breadth half the rule breadth of the vessel, add one-half the product of the height and length in feet of such erections.

Where erections are fitted upon erections, the equipment number is to be correspondingly increased.

To entitle vessels classed A "For Channel Purposes," to the Figure 1, the equipment of Anchors and Chain Cables, etc., should be as required by Table 31, with the exception that not more than two Bower Anchors and one Stream Anchor need be supplied, the first Bower Anchor should be of the full weight required by the Table, and the second Bower may be 15 per cent. lighter. This rule, however, applies only to vessels intended for short passages. In vessels classed "For Channel Purposes," which are intended for longer voyages, such as the Queenboro' and Flushing, the Channel Islands or the Irish Sea service, the equipment must be in accordance with the requirements of Table 31.

(b) In order to meet the requirements of different trades, the weight of Anchors as given in the Table may be modified as under :—

Where two Bower Anchors are required, one of them may be $7\frac{1}{2}$ per cent. lighter than the weight set forth in the Table, provided the collective weight of the two Anchors is equal to that given in the Table.

Where three Bower Anchors are required, one of them may be 15 per cent., and another $7\frac{1}{2}$ per cent. lighter than the weight set forth in the Table, provided the collective weight of the three Anchors is equal to that given in Table. Where it may be desired by the Owners the Bower Anchors may be of equal weight, provided the collective weight be not less than required by the Table.

For sailing vessels: in no case may the best Bower Anchor be lighter than prescribed in the Table, nor the third Bower be lighter than is allowed by this footnote.

All Anchor Stocks must be of acknowledged and approved description, and be one-fourth the weight of the Anchor given in the Table.

The heads of Stockless Anchors should not be less than three-fifths of the total weight of the Anchor.

(c) Stockless Stream and Kedge Anchors.—In the case of Stockless Stream and Kedge Anchors, an addition to the weight specified in this Table must be made of one-fourth to compensate for the deficiency in weight consequent on the absence of Stock.

(d) All Anchors, including Stream and Kedge Anchors exceeding 168lbs. in weight, including Stock, to be tested according to the requirements of the Act of Parliament and the Certificates of Test produced.

(e) The Chain Cables and Stream Chains to be tested in all cases according to the requirements of the Act of Parliament, and the Certificates of Test produced.

(f) There should be included in the weights, 2 End Shackles to each Cable ; that is 4 for each outfit, which contains two Cables.

(g) There should be included in the weights, 2 End Shackles to each Stream Chain.

(h) Unstudded close-link Chains will be admitted as Cables, if proved *two-thirds* the Test required for Stud-link Chains for the *tensile* strain, and 100 per cent. above the *tensile* strain for the *breaking* strain.

(i) When steel wire Towlines or Hawsers are adopted, see notes (i) below.

Where a departure from the requirements of this Table is proposed by an Owner the same should be submitted in the first place for the consideration of the Committee.

N.B.—The Italic letters preceding the Equipment Numbers correspond with letters printed in the seventh column in the List of Steam Vessels in the Register Book to indicate the Equipment Numbers of vessels per this Table.

(i) STEEL WIRE TOWLINES, HAWSERS AND WARPS.

(i) When steel wire towlines, hawsers, or warps are adopted, a short length of each of the wires composing the towlines, &c., will be required, after being galvanized, to withstand a tensile stress equivalent to that set forth in Table 31, and the aggregate strength of the wires must not be less than 10 per cent. in excess of that stress.

The use of flexible steel wire rope made of six strands of 18 wires laid round a hemp core will be approved when desired by the Owners, provided the rope is of the same size and strength as the ordinary steel wire hawser required by Tables 30 & 31.

Each wire will be required to be capable of being twisted around itself not less than eight times, and of being untwisted and straightened without breaking.

Each manufacturer to be required to provide on his premises machines suitable for satisfactorily making the foregoing tests, and the works to be at all times open to the inspection of the Society's Surveyors, who are to be empowered to retest any hawser or towline for which a certificate has been issued by the manufacturer.

Printed Forms of Certificates, approved by the Committee, to be given by the Manufacturers of Steel Wire Hawsers, will be supplied to them upon application to the Secretary.

SPECIAL FLEXIBLE STEEL WIRE ROPE.

When an Owner prefers to substitute special flexible steel wire ropes for steel wire rope of ordinary make, the sizes may be reduced in accordance with the following Table, provided each flexible rope be formed of six strands with 24 wires in each strand, and that the diameter of each wire is $\frac{1}{18}$th of the circumference of the rope, and the ropes are capable of withstanding the breaking tests shown in the Table :—

FLEXIBLE STEEL WIRE ROPE. Size.	Breaking Test.	CORRESPONDING SIZES REQUIRED BY TABLE 31.	FLEXIBLE STEEL WIRE ROPE. Size.	Breaking Test.	CORRESPONDING SIZES REQUIRED BY TABLE 31.
Inches.	Tons.	Inches.	Inches.	Tons.	Inches.
$1\frac{3}{4}$	8·9	2	$3\frac{1}{2}$	35·5	$4\frac{1}{2}$
2	11·7	$2\frac{1}{4}$	$3\frac{3}{4}$	41·0	$4\frac{5}{8}$
$2\frac{1}{2}$	18·2	$2\frac{3}{4}$	$4\frac{1}{4}$	52·5	$4\frac{7}{8}$
$2\frac{1}{2}$	18·2	3	$4\frac{1}{2}$	59·0	5
$2\frac{3}{4}$	22·0	$3\frac{1}{4}$	$4\frac{3}{4}$	65·5	$5\frac{1}{4}$
3	26·2	$3\frac{3}{8}$	5	73·0	$5\frac{3}{8}$
$3\frac{1}{4}$	30·7	$3\frac{3}{4}$	$5\frac{1}{2}$	88·0	6
$3\frac{1}{2}$	35·5	4	$6\frac{1}{4}$	114·0	7

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RENEWAL OF CHAIN CABLES WHEN WORN.

When any length of a Chain Cable is worn so that the mean diameter at its most worn part is reduced to the size given in the following Table it is to be renewed.

Size of Chain Cable originally.	Should be renewed when worn to	Size of Chain Cable originally.	Should be renewed when worn to	Size of Chain Cable originally.	Should be renewed when worn to	Size of Chain Cable originally.	Should be renewed when worn to
Diameter in inches.	Mean diameter in inches.	Diameter in inches.	Mean diameter in inches.	Diameter in inches.	Mean diameter in inches.	Diameter in inches.	Mean diameter in inches.
$1\frac{1}{16}$	$\frac{20}{32}$	$1\frac{4}{16}$	$1\frac{2}{16}$	$1\frac{13}{16}$	$1\frac{10}{16}$	$2\frac{6}{16}$	$2\frac{2}{16}$
$1\frac{2}{16}$	$\frac{21}{32}$	$1\frac{5}{16}$	$1\frac{3}{16}$	$1\frac{14}{16}$	$1\frac{11}{16}$	$2\frac{7}{16}$	$2\frac{3}{16}$
$1\frac{3}{16}$	$\frac{23}{32}$	$1\frac{6}{16}$	$1\frac{7}{32}$	$1\frac{15}{16}$	$1\frac{23}{32}$	$2\frac{8}{16}$	$2\frac{4}{16}$
$1\frac{4}{16}$	$\frac{25}{32}$	$1\frac{7}{16}$	$1\frac{9}{32}$	2	$1\frac{25}{32}$	$2\frac{9}{16}$	$2\frac{9}{32}$
$1\frac{5}{16}$	$\frac{27}{32}$	$1\frac{8}{16}$	$1\frac{11}{32}$	$2\frac{1}{16}$	$1\frac{27}{32}$	$2\frac{10}{16}$	$2\frac{11}{32}$
1	$\frac{29}{32}$	$1\frac{9}{16}$	$1\frac{13}{32}$	$2\frac{2}{16}$	$1\frac{29}{32}$	$2\frac{11}{16}$	$2\frac{13}{32}$
$1\frac{1}{16}$	$\frac{15}{16}$	$1\frac{10}{16}$	$1\frac{15}{32}$	$2\frac{3}{16}$	$1\frac{31}{32}$	$2\frac{12}{16}$	$2\frac{15}{32}$
$1\frac{2}{16}$	1	$1\frac{11}{16}$	$1\frac{8}{16}$	$2\frac{4}{16}$	2	$2\frac{13}{16}$	$2\frac{17}{32}$
$1\frac{3}{16}$	$1\frac{1}{16}$	$1\frac{12}{16}$	$1\frac{9}{16}$	$2\frac{5}{16}$	$2\frac{1}{16}$	$2\frac{14}{16}$	$2\frac{9}{16}$

Extract from the Rules for Wood and Composite Vessels, Section 32.

Tonnage for Regulating the Scantlings and Equipment (as regards Anchors, Chains, &c.).

In flush-decked vessels having either one, two or three decks (not being spar or awning-decked), the tonnage under the upper deck, *without abatement of the tonnage of the space for the crew, or for the propelling power of steam vessels*, is to regulate all the scantlings of the hull, and also the equipment of the vessel, as regards anchors, chains, warps, &c.

† In vessels having a *raised quarter deck*, or a poop, or top-gallant forecastle, or deck houses, or awning-deck, or spar deck, the total tonnage below the tonnage deck is to regulate the scantlings of the hull, but the register tonnage, as cut on the main beam of sailing vessels and of steam vessels, *with the addition of the tonnage of the space required for propelling power*, is to regulate the equipment.

But in vessels where the tonnage of the erections above the tonnage deck is less than that allowed for crew space, *then* the *difference* between the tonnage of these erections and the tonnage of the space allowed for crew is to be *added* to the register tonnage, cut on the main beam, for the tonnage that is to regulate the equipment.

LLOYD'S REGISTER OF SHIPPING.

ANCHORS.

Anchors may only be made of forged wrought iron, or forged open hearth ingot steel, or cast steel; the use of Basic Bessemer steel is, however, prohibited. Each important part of a forged anchor must be plainly marked by the Makers with the words 'Forged Wrought Iron,' or 'Forged Open Hearth Ingot Steel.' Anchor shackles, if of steel, must be forged and unwelded.

CAST STEEL ANCHORS.

All Cast Steel Anchors intended for vessels classed or proposed to be classed in the Society's Register Book must, in addition to undergoing the statutory tests, be subjected to the percussive, hammering, and bending tests recommended in the report of the Committee appointed by the Board of Trade to consider the question of tests of Cast Steel Anchors.

These tests, which are hereunder set forth, must be carefully and completely made in the presence and to the satisfaction of officers appointed by the Committee, viz. :—

PERCUSSIVE TEST.

1. Anchors, or when anchors are made of more than one piece, each piece shall be subject to this test, as follows :—

GIVEN WEIGHT.	GIVEN HEIGHT.
15 cwt. and below	15 feet.
Above 15 cwt.	12 feet.

The anchor or piece shall be raised the given height for the given weight and shall be dropped on an iron slab.

The given height means that the lowest part of the anchor or piece when suspended shall be at least the given height above the iron slab to which it is to be dropped.

2. An anchor of the Admiralty pattern shall first be raised vertically to the given height with its shanks and arms in a horizontal position, and shall be let fall from that height.

3. It shall then be raised a second time to the given height, and shall be suspended with the crown downwards. Two iron blocks shall be placed underneath it, and it shall be let fall from this position so that one of the blocks receives it on the middle of one arm, and the other block receives it on the middle of the other arm.

4. The slab for the horizontal test shall be of steel or iron, well laid on a solid concrete foundation to the satisfaction of the inspector.

5. If the slab on which the anchor falls is broken, the test shall be repeated until a slab is made that does not break.

6. The blocks for the vertical test shall be solid, and shall be of sufficient height to prevent the crown of the anchor from touching the slab, and shall be otherwise to the satisfaction of the inspector.

HAMMERING TEST.

7. When the percussive test has been passed successfully, to the satisfaction of the inspector, the anchor or piece shall be slung and freely put to a hammering test as follows, that is to say, it shall be well hammered over its parts with a sledge hammer weighing not less than 7 lbs., and shall be required to give under this treatment such a clear ring in all its parts as shall satisfy the inspector that the casting is sound, and without flaws existing, either originally or developed as the result of the application of the preceding percussive tests.

BENDING TEST.

8. Cast steel may be passed as sufficiently ductile for anchors when a piece of each casting, 8 inches in length, is cut from the casting, turned to 1 inch in diameter, and is then bent cold by hammering through an angle of 90 degrees over a radius of $1\frac{1}{2}$ inches, without showing signs of flaw or fracture.

9. There must be a piece cast on each cast steel anchor, or on each portion of such anchor when it is made of more than one casting, and such piece must be of sufficient size to enable one test piece of the size before stated to be cut out of it, or it may be (at the discretion of the manufacturer) of sufficient size to enable four test pieces to be cut out of it. If it is only of sufficient size to enable one test piece to be cut out of it, that piece shall be subjected to the bending test named in paragraph 8, and, if it fails to withstand it, the casting is to be condemned.

If the piece is large enough to enable four test pieces to be cut out of it, these four test pieces shall be disposed of as follows, that is to say, one of them shall be turned in a lathe to 1 inch in diameter for a length of 8 inches, and bent cold through an angle of 90 degrees over a radius of $1\frac{1}{2}$ inches, and if it withstands this test without flaw or fracture, shall be deemed to have withstood a satisfactory test for ductility. If the one test piece does not pass this test, all or any of the other three test pieces may be tested in a similar manner, and if any one of the four test pieces passes this test, the anchor or part of the anchor, as the case may be, shall be deemed so far satisfactory.

ANNEALING.

10. Each anchor must be properly and sufficiently annealed, and, when so annealed, shall be stamped "annealed steel." Annealing is not to be regarded as proper, or efficient, unless the process extends from three days for small anchors, up to six days for large ones.

PROVING ESTABLISHMENTS.

The following Proving Establishments are recognised by the Committee of Lloyd's Register for the Testing of Anchors and Chains while licensed by the Board of Trade for that purpose :—

NETHERTON (near Dudley)—Lloyd's Proving House	Superintendent,	Mr. H. Green.
TIPTON—Lloyd's Proving House	ditto	Mr. W. A. Drysdale.
LOW WALKER—Lloyd's Proving House	ditto	Mr. A. Green.
CHESTER (Saltney)—Lloyd's Proving House	ditto	Mr. J. R. Parsons.
GLASGOW—Lloyd's Proving House	ditto	Mr. E. Seedhouse.
CARDIFF—Lloyd's Proving House	ditto	Mr. A. Jones.
SUNDERLAND—Lloyd's Proving House	ditto	Mr. L. Haffner.
CRADLEY HEATH—Lloyd's Proving House	ditto	Mr. S. C. Paul.

N.B.—Vessels supplied with Anchors and Chain Cables tested at any of the Proving Establishments in the above list, will have the notation of "Lloyd'sA.&C.P." in the Register Book, signifying that the Anchors and Chain Cables have been tested at a machine under the control of the Committee of Lloyd's Register of Shipping.

The following Machines have been recognised by the Committee for the testing of Anchors and Chain Cables supplied to vessels of other than British Registry (*see* Section 50 of the Rules) :—

BELGIUM	Antwerp Engineering Co., Société Anonyme, Rue des Indes, Antwerp.
„	Société Anonyme de Clouteries Mécaniques, Fontaine l'Evêque (for the testing of small Chains only).
„	Société Anonyme des Usines Wattelar-Francq., Roux.
CANADA	Thos. Davidson Manufacturing Co., Lim., Turcot, Montreal.
„	McKinnon-Columbus Chain, Lim., St. Catherine's, Ontario.
CZECHO-SLOVAKIA.	Gyertyanligeter Eisenwerke & Stahlhütte Josef Bratmann, Gyertyanliget.
„ „	Voigtmann & Sohne, Janowitz, near Romerstadt, Maren.
DENMARK	A/S Ankerkaedefabriken, Bronderslev.
„	Government Establishment at Copenhagen.
FRANCE	Chaineries de St. Amand, Etablissements Dorémieux, Davaine & Quinet, St. Amand (Nord).
„	Chantiers & Ateliérs Bordelais et Chaineries de la Gironde, Bordeaux.
„	Chantiers de la Loire, Nantes.
„	E. Turbot, Anzin (Nord).
„	Vve. E. Couillard, Succr., Havre.
„	Marrel Frères, Capelette, Marseilles.
„	M. Hemet, Havre.
„	Société Nouvelle des Forges & Chaineries du Nord, St. Amand-les-Eaux (Nord).
GERMAN-AUSTRIA	F. F. von Helldorff & Otto Rothhart, Brückl-Kärnten.
GERMANY	Otto Gruson & Co., Magdeburg (for the testing of Anchors only).
HOLLAND	Koninklijke Nederlandsche Grofsmederij, Leiden.
„	N. V. Nederlandsche Industrie & Handel-maatschappij "Keilehaven," Rotterdam.
ITALY	Ansaldo, Gio., & Co., Cornigliano Ligure.
„	Catenificio Ing. Carlo Bassoli & Co., Leghorn.
„	Laminatojo Arlenico, Lecco.
„	Direzione Costruzioni Navali dell'Arsenale, Pola (approved for loads 50 tons upwards).
„	Regia Marina — Direzione Costruzioni Navali — Laboratorio Sperimentale, Regio Arsenale, Spezia.
„	Stahlwerke Weissenfels, Act. Ges., Julisch-Venetien (for the testing of small Chains only).
JAPAN	Kaiji Kyokai Proving House (Japan Lloyd's), Yokohama.
„	Kobe Steel Works, Kobe (for the testing of Anchors only).
„	Mitsu Bishi Dockyard & Engine Works, Nagasaki.
„	Osaka Chain Works. Lim., Osaka.
„	Oshima Steel Works, Oshima, Tokio (for the testing of Anchors only).
NORWAY	A/S Kjaettingfabriken, Christiania (for testing Chains up to 30 tons).
„	Aktieselskabet Starkad, Moss.
„	Norsk Ankerkjaettingfabrik A/S., Christiania.
SWEDEN	Statens Profningsanstalt (Government Establishment), Stockholm.
„	Ljusne Chain Works (Ljusne Kätting-fabrik), Ljusne.
„	Ramnäs Bruks Aktiebolag, Ramnäs.
„	Tonshammars Bruks Nya Aktiebolag, Sandarne.
UNITED STATES	American Chain Co., Columbus, Ohio; Sewells Point, Norfolk, Va., and Braddock, near Pittsburgh, Pa.
„ „	American Steel Casting Co., Chester, Pa. (for the testing of Anchors only).
„ „	Baldt Anchor Co., Chester, Pa.
„ „	Bradlee & Co.'s Works, Philadelphia, Pa.
„ „	Buckeye Steel Castings Co., Columbus, Ohio (for breaking tests on Chain Cables only).
„ „	Cape Ann Anchor Works, Gloucester, Mass.
„ „	J. B. Carr Co., Troy, N.Y.
„ „	Cleveland Steel Casting Co., Cleveland, Ohio (for the testing of Anchors only).
„ „	Columbia Steel Co., Lim., Pittsburgh, Cal. (for the testing of Anchors only).
„ „	Columbus McKinnon Chain Co., Columbus, Ohio, and Lebanon, Pa.
„ „	Frankford Chain Works, Frankford, Philadelphia, Pa.
„ „	Herreshoff Manufacturing Co., Bristol, R.I. (for the testing of Anchors only).
„ „	Jones & Laughlin Steel Co., Pittsburgh, Pa.
„ „	Knoxville Iron Co., Knoxville, Tenn.
„ „	Lebanon Chain Works, Lebanon, Pa.
„ „	The Logan Iron and Steel Co., Burnham, Pa.
„ „	J. McKay & Co.'s Iron City Chain Works, McKees Rocks, near Pittsburgh, Pa.
„ „	National Malleable Castings Co., Cleveland, Ohio.
„ „	Osgood Bradley Car Co., Worcester, Mass.
„ „	Penn Seaboard Steel Corporation, Chester, Pa. (for the testing of Anchors only).
„ „	Seattle Chain Co., 6921, East Marginal Way, Seattle, Wash.
„ „	Seneca Chain Co., Kent, Ohio.
„ „	United States Chain & Forging Co., Columbus, Ohio, and Marietta, Ohio.
„ „	Weimer Chain & Iron Co., Lebanon, Pa.
„ „	Whitehill Chain Works, Whitehill, Fieldsboro, N.J.
„ „	Woodhouse Chain Works, Trenton, N.J.
UPPER SILESIA	A. Borsig, Berg und Hüttenverwaltung Borsigwerk, Borsigwerk.

By order of the Committee,

ANDREW SCOTT,

Secretary.

LONDON.—*6th July, 1921.*

TABLES 32 TO 36

FOR

VESSELS INTENDED TO CARRY OIL IN BULK.

VESSELS INTENDED TO CARRY OIL IN BULK.

WEB FRAMES and STRINGERS.

TABLE 32.

(See Continuation.)

TRANSVERSE NUMBER. B+D. Feet.	DEPTH (d) AT MIDDLE OF LENGTH FROM TOP OF ORDINARY FLOORS AT CENTRE TO TOP OF BEAMS AT SIDE OF TANK DECK.																
	Feet. Above 11 and not exceeding 12	Feet. Above 12 and not exceeding 13	Feet. Above 13 and not exceeding 14	Feet. Above 14 and not exceeding 15	Feet. Above 15 and not exceeding 16	Feet. Above 16 and not exceeding 17	Feet. Above 17 and not exceeding 18	Feet. Above 18 and not exceeding 19	Feet. Above 19 and not exceeding 20	Feet. Above 20 and not exceeding 21	Feet. Above 21 and not exceeding 22	Feet. Above 22 and not exceeding 23	Feet. Above 23 and not exceeding 24	Feet. Above 24 and not exceeding 25	Feet. Above 25 and not exceeding 26	Feet. Above 26 and not exceeding 27
	<----------TWO SIDE STRINGERS---------->							<-------THREE SIDE STRINGERS------->					<----FOUR SIDE STRINGERS---->			
Above not exceeding	inches.	inches.	inches.	inches.	inches.	inches.	inches.	inches.	inches.	inches.	inches.	inches.	inches.	inches.	inches.	inches.
45 and 48	12 × ·26	13 × ·26	13 × ·28	13 × ·30	14 × ·30	14 × ·32	14 × ·34									
48 „ 51	13 × ·26	13 × ·28	13 × ·30	14 × ·30	14 × ·32	14 × ·34	14 × ·36	15 × ·36								
51 „ 54	13 × ·28	13 × ·30	14 × ·30	14 × ·32	14 × ·34	14 × ·36	15 × ·36	16 × ·36	16 × ·38							
54 „ 57	13 × ·30	14 × ·30	14 × ·32	14 × ·34	14 × ·36	15 × ·36	16 × ·36	16 × ·38	17 × ·38	18 × ·38						
57 „ 60	14 × ·30	14 × ·32	14 × ·34	14 × ·36	15 × ·36	16 × ·36	16 × ·38	17 × ·38	18 × ·38	18 × ·40	19 × ·40	20 × ·42				
60 „ 63	14 × ·32	14 × ·34	14 × ·36	15 × ·36	16 × ·36	16 × ·38	17 × ·38	18 × ·38	18 × ·40	19 × ·40	20 × ·40	21 × ·42	22 × ·44	24 × ·44		
63 „ 66	14 × ·34	14 × ·36	15 × ·36	16 × ·36	16 × ·38	17 × ·38	18 × ·38	18 × ·40	19 × ·40	20 × ·40	21 × ·40	22 × ·42	23 × ·44	24 × ·46	26 × ·46	27 × ·48
66 „ 69		15 × ·36	16 × ·36	16 × ·38	17 × ·38	18 × ·38	18 × ·40	19 × ·40	20 × ·40	20 × ·42	21 × ·42	22 × ·44	24 × ·44	25 × ·46	26 × ·48	28 × ·48
69 „ 72			16 × ·38	17 × ·38	18 × ·38	18 × ·40	19 × ·40	20 × ·40	20 × ·42	21 × ·42	22 × ·42	23 × ·44	24 × ·46	26 × ·46	27 × ·48	28 × ·50
72 „ 75				18 × ·38	18 × ·40	19 × ·40	20 × ·40	20 × ·42	21 × ·42	22 × ·42	23 × ·42	24 × ·44	25 × ·46	26 × ·48	28 × ·48	29 × ·50
75 „ 78					19 × ·40	20 × ·40	20 × ·42	21 × ·42	22 × ·42	22 × ·44	23 × ·44	24 × ·46	26 × ·46	27 × ·48	28 × ·50	30 × ·50
78 „ 81						20 × ·42	21 × ·42	22 × ·42	22 × ·44	23 × ·44	24 × ·44	25 × ·46	26 × ·48	28 × ·48	29 × ·50	30 × ·52
81 „ 84							22 × ·42	22 × ·44	23 × ·44	24 × ·44	25 × ·44	26 × ·46	27 × ·48	28 × ·50	30 × ·50	31 × ·52
84 „ 87								23 × ·44	24 × ·44	24 × ·46	25 × ·46	26 × ·48	28 × ·48	29 × ·50	30 × ·52	32 × ·52
87 „ 90									24 × ·46	25 × ·46	26 × ·46	27 × ·48	28 × ·50	30 × ·50	31 × ·52	32 × ·54
90 „ 93										26 × ·48	27 × ·48	28 × ·50	30 × ·50	31 × ·52	32 × ·54	34 × ·54
93 „ 96											29 × ·48	30 × ·50	31 × ·52	32 × ·54	34 × ·54	35 × ·56
96 „ 99												31 × ·52	32 × ·54	34 × ·54	35 × ·56	36 × ·58

The stringers are to be of the same dimensions as the web frames and are to be attached to the outside plating by double angles for a length of three frame spaces on each side of the bulkheads.

The web frames are to be spaced not more than four frame spaces apart.

The web frames are to be attached to the outside plating by double angles where their depth is 24 inches or above.

VESSELS INTENDED TO CARRY OIL IN BULK.

INTERMEDIATE FRAMES, FACE ANGLES, &c.

TABLE 32. *(Concluded.)*

TRANSVERSE NUMBER. B+D. Feet. Above / not exceeding	FRAME SPACING	INTERMEDIATE FRAMES. Built Framing. Frames*	INTERMEDIATE FRAMES. Built Framing. Reversed Frames.†	INTERMEDIATE FRAMES. Bulb Angles.	ANGLES ATTACHING WEB FRAMES, SIDE STRINGERS AND KEELSONS TO OUTSIDE PLATING; DOUBLE FACE ANGLES TO WEB FRAMES AND STRINGERS; AND DOUBLE ANGLES CONNECTING STRINGERS TO WEB FRAMES.	SINGLE FACE ANGLES TO WEB FRAMES AND SIDE STRINGERS.	BUTT STRAPS FOR STRINGER FACE ANGLES. Dimensions. Length.	Breadth.	Thickness.	Rivets. Number in Straps and Stringer Face Angles.	Number in Straps and Web Frame Face Angles.	WEB FRAMES IN 'TWEEN DECKS. Depth. At Heel.	At Head.	Thickness.
	inches.	inches.	inches.	inches.	inches.	inches.	inches.	inches.	inches.					inches.	inches.	inches.
45 and 48	22½	3½ × 3 × ·30	2½ × 2½ × ·30		3 × 3 × ·30	5 × 3 × ·48	33	10	·46	16	4				
48 „ 51	22½	3½ × 3 × ·30	3 × 2½ × ·30		3 × 3 × ·30	5 × 3 × ·48	„	„	„	„	„				
51 „ 54	23	3½ × 3 × ·30	3 × 3 × ·30		3 × 3 × ·32	5 × 3 × ·50	„	„	„	„	„				
54 „ 57	23	4 × 3 × ·30	3 × 3 × ·30		3 × 3 × ·34	5 × 3 × ·52	„	„	·48	„	„	15	15	·34	
57 „ 60	23½	4½ × 3 × ·30	3 × 3 × ·30	5½ × 3 × ·36	3 × 3 × ·36	5 × 3½ × ·52	42	11	„	20	6	15	15	·34	
60 „ 63	23½	4½ × 3 × ·32	3 × 3 × ·32	5½ × 3 × ·38	3½ × 3 × ·36	5 × 3½ × ·54	„	„	·50	„	„	15	15	·36	
63 „ 66	24	5 × 3 × ·32	3 × 3 × ·32	6 × 3 × ·38	3½ × 3 × ·38	6 × 3½ × ·54	„	„	„	„	„	18	15	·36	
66 „ 69	24	5 × 3 × ·34	3 × 3 × ·34	6 × 3 × ·40	3½ × 3 × ·40	6 × 3½ × ·56	„	„	·52	„	„	21	18	·38	
69 „ 72	24½	5½ × 3½ × ·34	3 × 3 × ·34	6½ × 3½ × ·40	3½ × 3½ × ·40	6½ × 3½ × ·58	45	12	„	„	„	24	18	·38	
72 „ 75	24½	5½ × 3½ × ·34	3½ × 3 × ·34	6½ × 3½ × ·40	3½ × 3½ × ·42	6½ × 3½ × ·60	„	„	·54	„	„	27	21	·38	
75 „ 78	25	5½ × 3½ × ·36	3½ × 3 × ·36	6½ × 3½ × ·42	3½ × 3½ × ·44	7 × 3½ × ·60	„	„	„	„	„	30	21	·40	
78 „ 81	25	6 × 3½ × ·36	3½ × 3 × ·36	7 × 3½ × ·42	3½ × 3½ × ·46	7 × 3½ × ·62	„	„	·56	„	„	30	21	·40	
81 „ 84	25½	6 × 3½ × ·38	3½ × 3 × ·38	7 × 3½ × ·44	3½ × 3½ × ·48	7 × 3½ × ·64	„	„	„	„	„	33	21	·42	
84 „ 87	25½	6½ × 3½ × ·38	3½ × 3 × ·38	7½ × 3½ × ·44	3½ × 3½ × ·50	7 × 3½ × ·66	„	„	·58	„	„	33	21	·42	
87 „ 90	26	6½ × 3½ × ·40	3½ × 3 × ·40	7½ × 3½ × ·46	3½ × 3½ × ·52	7 × 3½ × ·68	„	„	„	„	„	36	24	·44	
90 „ 93	26	7 × 3½ × ·40	3½ × 3 × ·40	8 × 3½ × ·46	4 × 3½ × ·52	7 × 3½ × ·72	„	„	·60	„	„	36	24	·44	
93 „ 96	26½	7 × 3½ × ·42	3½ × 3 × ·42	8 × 3½ × ·48	4 × 3½ × ·54	7 × 3½ × ·76	„	„	„	„	„	39	24	·46	
96 „ 99	26½	7 × 3½ × ·42	3½ × 3½ × ·42	8½ × 3½ × ·48	4 × 3½ × ·56	7 × 3½ × ·80	„	„	·62	„	„	39	24	·46	

*The frames in the 'tween decks, may be of angles ·06 of an inch thicker than required by the Table, in which case the reversed frames may be dispensed with.

†The reversed frame at upper edge of floor plates to be of the dimensions required for double face angles on webs.

VESSELS INTENDED TO CARRY OIL IN BULK.

FLOOR PLATES. TABLE 33.

TRANSVERSE NUMBER. B + D. Above Feet.	and not exceeding	DEPTH AT CENTRE.	THICKNESS. * For $\frac{3}{5}$ length Amidships.	THICKNESS. * At Ends.
		inches.	inches.	inches.
45	46	17	·34	·30
46 „	47	18	·34	·30
47 „	48	18	·36	·32
48 „	49	19	·36	·32
49 „	50	20	·36	·32
50 „	51	20	·38	·34
51 „	52	21	·38	·34
52 „	53	22	·38	·34
53 „	54	22	·40	·34
54 „	55	23	·40	·34
55 „	56	24	·40	·34
56 „	58	24	·42	·36
58 „	60	25	·42	·36
60 „	62	26	·42	·36
62 „	64	26	·44	·36
64 „	66	27	·44	·36
66 „	68	28	·44	·36
68	70	28	·46	·38
70 „	72	29	·46	·38
72 „	74	30	·46	·38
74 „	76	30	·48	·38
76 „	78	31	·48	·38
78 „	80	32	·48	·38
80 „	82	32	·50	·40
82 „	84	33	·50	·40
84 „	86	34	·50	·40
86 „	88	35	·50	·40
88 „	90	35	·52	·40
90 „	92	36	·52	·40
92 „	94	37	·52	·40
94 „	96	38	·52	·40
96 „	98	38	·54	·42
98 „	100	39	·54	·42

* In the engine space of steam vessels the floors are to be ·04 of an inch thicker, and in the boiler space ·10 of an inch thicker than required by the Table.

VESSELS INTENDED TO CARRY OIL IN BULK.

FLAT KEEL ANGLES, and SIDE and BILGE KEELSONS. TABLE 34.

LONGITUDINAL NUMBER. L × (B + D).	FLAT KEEL ANGLES.		SIDE AND BILGE KEELSONS.				
	For ½ length Amidships.	Thickness at Ends.	For ½ length Amidships.	Thickness at Ends.	Intercostal Plates.	Angles on Vertical Plate. For ½ length Amidships.	Angles on Vertical Plate. Thickness at Ends.
	inches.	inches.	inches.	inches.	inches.	inches.	inches.
Above 7000 and not exceeding 7600	3½ × 3½ × ·38	·38	Double Angles. 3½ × 3 × ·34	·34	·32		
7600 „ 8200	3½ × 3½ × ·40	·38	4 × 3 × ·34	·34	·32		
8200 „ 8800	3½ × 3½ × ·42	·40	4 × 3 × ·34	·34	·32		
8800 „ 9400	3½ × 3½ × ·42	·40	4 × 3 × ·36	·34	·34		
9400 „ 10000	3½ × 3½ × ·44	·42	4 × 3 × ·36	·34	·34		
10000 „ 10600	3½ × 3½ × ·44	·42	4½ × 3 × ·36	·34	·34		
10600 „ 11800	4 × 4 × ·46	·44	4½ × 3½ × ·36	·34	·36		
11800 „ 12400	4 × 4 × ·46	·44	5 × 3½ × ·36	·34	·36		
12400 „ 13000	4 × 4 × ·48	·46	5 × 3½ × ·38	·36	·38		
13000 „ 14200	4 × 4 × ·48	·46	5 × 3½ × ·40	·36	·38		
14200 „ 15400	4 × 4 × ·50	·48	5½ × 3½ × ·40	·36	·38		
15400 „ 16000	4 × 4 × ·50	·48	5½ × 3½ × ·42	·36	·38		
16000 „ 16600	4 × 4 × ·52	·48	6 × 3½ × ·42	·36	·40		
16600 „ 17200	4 × 4 × ·52	·48	6 × 3½ × ·42	·36	·40		
17200 „ 18000	4 × 4 × ·52	·48	Double Bulb Angles. 7 × 3½ × ·42	·40	·40		
18000 „ 19000	4 × 4 × ·54	·50	8 × 3½ × ·46	·44	·40		
19000 „ 20000	4 × 4 × ·54	·50	9 × 3½ × ·50	·46	·40		
20000 „ 21000	4 × 4 × ·54	·50	10 × 3½ × ·54	·48	·40		
21000 „ 22000	4 × 4 × ·54	·50	Vertical Plate, 11 × ·50	and Four ·40	Angles. ·42	6½ × 3½ × ·44	·38
22000 „ 24000	6 × 6 × ·54	·50	12 × ·52	·42	·42	6½ × 3½ × ·46	·38
24000 „ 26000	6 × 6 × ·54	·50	13 × ·54	·44	·42	6½ × 3½ × ·46	·38
26000 „ 28000	6 × 6 × ·56	·52	14 × ·56	·46	·42	6½ × 3½ × ·48	·38
28000 „ 30000	6 × 6 × ·56	·52	15 × ·58	·48	·42	6½ × 3½ × ·48	·38
30000 „ 32000	6 × 6 × ·56	·52	16 × ·60	·50	·42	6½ × 3½ × ·50	·40
32000 „ 34000	6 × 6 × ·58	·54	17 × ·62	·52	·42	6½ × 3½ × ·50	·40
34000 „ 36000	6 × 6 × ·58	·54	18 × ·64	·54	·44	7 × 3½ × ·50	·40
36000 „ 39000	6 × 6 × ·58	·54	19 × ·66	·56	·44	7 × 3½ × ·50	·40
39000 „ 42000	6 × 6 × ·60	·54	20 × ·68	·58	·44	7 × 3½ × ·50	·40
42000 „ 46000	6 × 6 × ·60	·54	21 × ·70	·60	·44	7 × 3½ × ·50	·40
46000 „ 50000	6 × 6 × ·60	·54	22 × ·72	·62	·44	7 × 3½ × ·50	·40

Where the breadth of the vessel is not more than 50 feet, two keelsons of the dimensions required by the Table are to be fitted on each side. Where the breadth exceeds 50 feet and does not exceed 64 feet, three keelsons are to be fitted on each side, in which case the depth of the vertical plates may be one-fourth less than given in the Table.

The keelsons required by the above Table are, so far as is practicable, to extend throughout the oil compartments and machinery space.

VESSELS INTENDED TO CARRY OIL IN BULK.

BULKHEADS. TABLE 35.

DEPTH FROM TOP OF FLOORS TO TOP OF BEAMS AT CENTRE OF TANK DECK.*	THICKNESS OF BULKHEAD PLATING.			VERTICAL STIFFENING BARS.**		HORIZONTAL GIRDERS BELOW TANK DECK.				WEB FRAMES ON TRANSVERSE BULKHEADS. DEPTH AT HEEL.†
	Below Tank Deck.		In Expansion Trunk.	Bulb Angles below Tank Deck.	Angles in Expansion Trunk.	1st (at bottom).	2nd.	3rd.	4th.	
Feet. Above / not exceeding	At Floor.	At Tank Deck.								
	inches.	inches.	inches.	inches.	inches.	inches. Channel.	inches. Channel.	inches. Channel.	inches. Channel.	inches.
12 and 13	·34	·32	·30	$5\frac{1}{2} \times 3 \times ·34$	$5 \times 3 \times ·30$	$9 \times 3\frac{1}{2} \times 3\frac{1}{2} \times ·50$	$9 \times 3\frac{1}{2} \times 3\frac{1}{2} \times ·50$			16
13 „ 14	·36	·32	·30	$5\frac{1}{2} \times 3 \times ·36$	$5 \times 3 \times ·32$	$10 \times 3\frac{1}{2} \times 3\frac{1}{2} \times ·50$	$9 \times 3\frac{1}{2} \times 3\frac{1}{2} \times ·50$			18
14 „ 15	·36	·32	·30	$5\frac{1}{2} \times 3 \times ·38$	$5 \times 3 \times ·32$	$10 \times 3\frac{1}{2} \times 3\frac{1}{2} \times ·50$	$10 \times 3\frac{1}{2} \times 3\frac{1}{2} \times ·50$			20
15 „ 16	·38	·34	·32	$6 \times 3 \times ·38$	$5 \times 3 \times ·34$	$12 \times 3\frac{1}{2} \times 3\frac{1}{2} \times ·50$	$10 \times 3\frac{1}{2} \times 3\frac{1}{2} \times ·50$			22
16 „ 17	·38	·34	·32	$6 \times 3 \times ·40$	$5 \times 3 \times ·34$	$12 \times 3\frac{1}{2} \times 3\frac{1}{2} \times ·50$	$12 \times 3\frac{1}{2} \times 3\frac{1}{2} \times ·50$			24
17 „ 18	·40	·34	·32	$6\frac{1}{2} \times 3 \times ·40$	$5 \times 3 \times ·36$	$15 \times 4 \times 4 \times ·52$	$12 \times 3\frac{1}{2} \times 3\frac{1}{2} \times ·50$			26
18 „ 19	·40	·36	·34	$6\frac{1}{2} \times 3 \times ·42$	$5 \times 3 \times ·36$	$15 \times 4 \times 4 \times ·52$	$15 \times 4 \times 4 \times ·52$			28
19 „ 20	·42	·36	·34	$6\frac{1}{2} \times 3 \times ·42$	$5 \times 3 \times ·38$	$15 \times 4 \times 4 \times ·52$	$12 \times 3\frac{1}{2} \times 3\frac{1}{2} \times ·50$	$12 \times 3\frac{1}{2} \times 3\frac{1}{2} \times ·50$		30
20 „ 21	·42	·36	·34	$7 \times 3 \times ·42$	$5 \times 3 \times ·38$	$15 \times 4 \times 4 \times ·52$	$15 \times 4 \times 4 \times ·52$	$12 \times 3\frac{1}{2} \times 3\frac{1}{2} \times ·50$		32
21 „ 22	·44	·38	·36	$7 \times 3 \times ·44$	$5 \times 3 \times ·40$	$15 \times 4 \times 4 \times ·52$	$15 \times 4 \times 4 \times ·52$	$15 \times 4 \times 4 \times ·52$		34
22 „ 23	·44	·38	·36	$7\frac{1}{2} \times 3 \times ·44$	$5 \times 3 \times ·40$	Plate. $20 \times ·40$	$15 \times 4 \times 4 \times ·52$	$15 \times 4 \times 4 \times ·52$		36
23 „ 24	·44	·38	·36	$7\frac{1}{2} \times 3 \times ·46$	$5\frac{1}{2} \times 3 \times ·40$	$22 \times ·40$	Plate. $20 \times ·40$	$15 \times 4 \times 4 \times ·52$		38
24 „ 25	·46	·40	·38	$7\frac{1}{2} \times 3 \times ·46$	$5\frac{1}{2} \times 3 \times ·40$	$22 \times ·40$	$20 \times ·40$	$15 \times 4 \times 4 \times ·52$	$15 \times 4 \times 4 \times ·52$	40
25 „ 26	·46	·40	·38	$8 \times 3 \times ·46$	$5\frac{1}{2} \times 3 \times ·40$	$24 \times ·42$	$22 \times ·40$	Plate. $20 \times ·40$	$15 \times 4 \times 4 \times ·52$	Two frame spaces.
26 „ 27	·46	·40	·38	$8 \times 3 \times ·48$	$5\frac{1}{2} \times 3 \times ·40$	$26 \times ·44$	$24 \times ·44$	$22 \times ·42$	Plate. $20 \times ·40$	„
27 „ 28	·48	·42	·40	$8\frac{1}{2} \times 3 \times ·48$	$5\frac{1}{2} \times 3 \times ·40$	$28 \times ·46$	$26 \times ·44$	$24 \times ·42$	$21 \times ·40$	„
28 „ 29	·48	·42	·40	$8\frac{1}{2} \times 3 \times ·50$	$5\frac{1}{2} \times 3 \times ·40$	$30 \times ·46$	$27 \times ·44$	$25 \times ·42$	$22 \times ·40$	„
29 „ 30	·48	·42	·40	$8\frac{1}{2} \times 3 \times ·52$	$5\frac{1}{2} \times 3 \times ·40$	$32 \times ·48$	$29 \times ·46$	$26 \times ·42$	$23 \times ·40$	„
30 „ 31	·50	·44	·42	$9 \times 3 \times ·52$	$5\frac{1}{2} \times 3 \times ·40$	$34 \times ·48$	$30 \times ·46$	$27 \times ·44$	$24 \times ·40$	„
31 „ 32	·50	·44	·42	$9 \times 3 \times ·54$	$5\frac{1}{2} \times 3 \times ·40$	$36 \times ·50$	$32 \times ·48$	$29 \times ·44$	$25 \times ·40$	„
32 „ 33	·50	·44	·42	$9 \times 3 \times ·56$	$5\frac{1}{2} \times 3 \times ·40$	$38 \times ·50$	$34 \times ·48$	$30 \times ·44$	$26 \times ·40$	„

* The depth is to be measured at the middle of the length of the vessel except for the thickness of bottom part of bulkhead plating, vertical stiffeners and horizontal girders below tank deck in which cases the depth is to be measured at the bulkheads.

** The vertical stiffeners on the middle line bulkheads are to be spaced as required for the frames of the vessel and those on the transverse bulkheads are also to be spaced as required for the frames, but are in no case to be more than 24 inches apart centre to centre.

Web plates are to be fitted to the middle line bulkheads opposite the web frames at the side of the vessel. Their thickness is to be as required for the plating of the lower part of the bulkhead, and the depth at the heel is not to be less than that of the floors at centre, and that at the head not less than two-thirds that at the heel.

† Two web plates are to be fitted to the transverse bulkheads on each side of the middle line where the breadth is not more than 50 feet, and three where the breadth is above 50 feet and not exceeding 64 feet. The web plates are to be of the thickness required for the plating of the lower part of the bulkhead. Their depth at heel is to be as given in the Table, and the depth at head equal to one frame space, but need not exceed that required at the heel.

Where the horizontal girders on bulkheads are formed of plates they are to have a bulb angle face bar of the dimensions required for the vertical stiffeners.

VESSELS INTENDED TO CARRY OIL IN BULK.

EXPANSION TRUNKS and BULKHEAD BOUNDARY BARS.

TABLE 36.

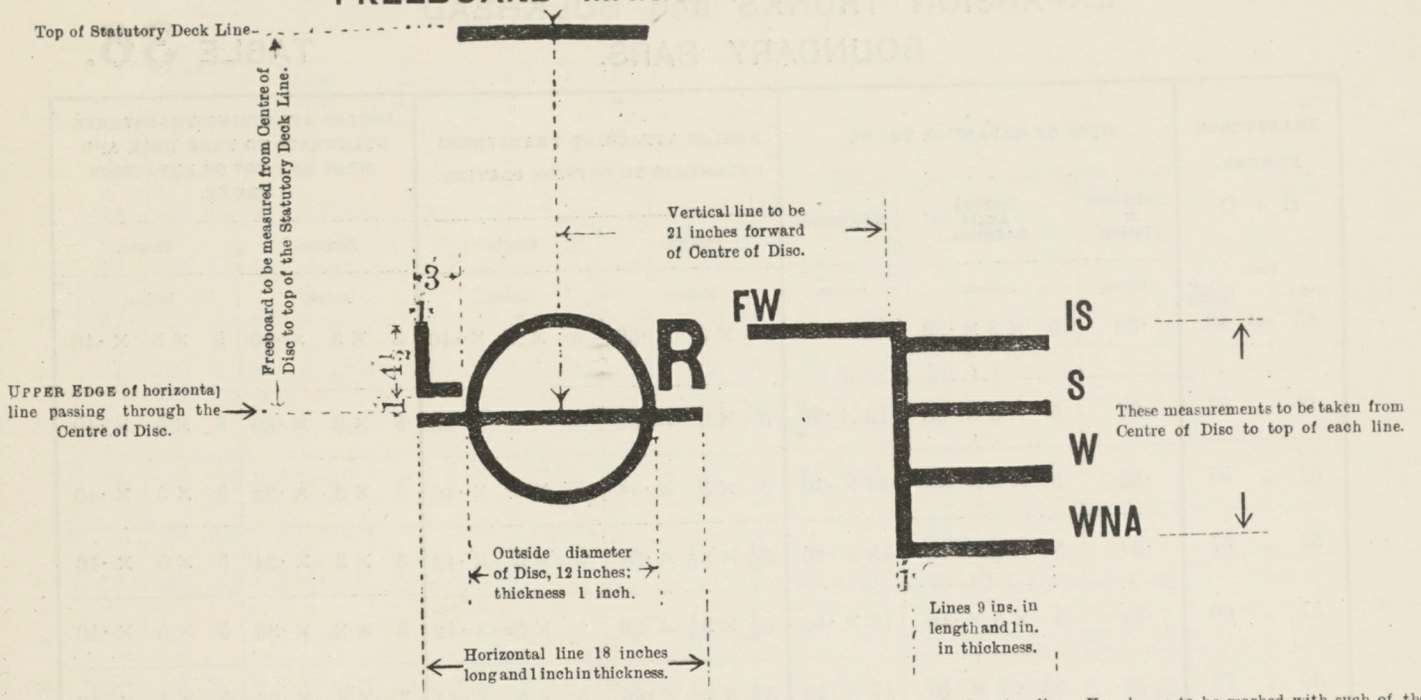
TRANSVERSE NUMBER. B + D	SIDES OF EXPANSION TRUNK.			ANGLES ATTACHING TRANSVERSE BULKHEADS TO OUTSIDE PLATING.		ANGLES ATTACHING TRANSVERSE BULKHEADS TO TANK DECK AND SIDES AND TOP OF EXPANSION TRUNK.	
	Thickness of Plating.	Vertical Angle Stiffeners.	Web Plates.	Double.	Single.	Double.	Single.
Feet. Above / not exceeding	inches.	inches.	inches.	inches.	inches.	inches.	inches.
45 and 48	·30	5 × 3 × ·38	12 × ·36	3 × 3 × ·30	5 × 5 × ·40	3 × 3 × ·30	5 × 5 × ·40
48 „ 51	·32	5 × 3 × ·38	13 × ·38	3 × 3 × ·32	5 × 5 × ·40	3 × 3 × ·30	5 × 5 × ·40
51 „ 54	·32	5 × 3 × ·40	14 × ·40	3 × 3 × ·34	5 × 5 × ·40	3 × 3 × ·32	5 × 5 × ·40
54 „ 57	·34	5 × 3 × ·40	15 × ·40	$3\frac{1}{2}$ × $3\frac{1}{2}$ × ·34	5 × 5 × ·42	3 × 3 × ·34	5 × 5 × ·40
57 „ 60	·34	5 × 3 × ·40	16 × ·40	$3\frac{1}{2}$ × $3\frac{1}{2}$ × ·36	5 × 5 × ·42	3 × 3 × ·36	5 × 5 × ·40
60 „ 63	·36	$5\frac{1}{2}$ × 3 × ·40	17 × ·40	$3\frac{1}{2}$ × $3\frac{1}{2}$ × ·36	5 × 5 × ·44	3 × 3 × ·36	5 × 5 × ·40
63 „ 66	·36	$5\frac{1}{2}$ × 3 × ·40	18 × ·40	$3\frac{1}{2}$ × $3\frac{1}{2}$ × ·38	5 × 5 × ·44	3 × 3 × ·38	5 × 5 × ·42
66 „ 69	·38	$5\frac{1}{2}$ × 3 × ·40	18 × ·40	$3\frac{1}{2}$ × $3\frac{1}{2}$ × ·38	5 × 5 × ·46	3 × 3 × ·40	5 × 5 × ·42
69 „ 72	·38	$5\frac{1}{2}$ × 3 × ·40	19 × ·40	$3\frac{1}{2}$ × $3\frac{1}{2}$ × ·40	5 × 5 × ·48	$3\frac{1}{2}$ × $3\frac{1}{2}$ × ·40	5 × 5 × ·44
72 „ 75	·40	6 × 3 × ·40	20 × ·40	$3\frac{1}{2}$ × $3\frac{1}{2}$ × ·42	5 × 5 × ·50	$3\frac{1}{2}$ × $3\frac{1}{2}$ × ·42	5 × 5 × ·44
75 „ 78	·40	6 × 3 × ·40	21 × ·40	$3\frac{1}{2}$ × $3\frac{1}{2}$ × ·44	5 × 5 × ·50	$3\frac{1}{2}$ × $3\frac{1}{2}$ × ·44	5 × 5 × ·46
78 „ 81	·40	6 × 3 × ·40	22 × ·40	$3\frac{1}{2}$ × $3\frac{1}{2}$ × ·44	5 × 5 × ·52	$3\frac{1}{2}$ × $3\frac{1}{2}$ × ·44	5 × 5 × ·46
81 „ 84	·42	$6\frac{1}{2}$ × 3 × ·40	23 × ·40	$3\frac{1}{2}$ × $3\frac{1}{2}$ × ·46	5 × 5 × ·52	$3\frac{1}{2}$ × $3\frac{1}{2}$ × ·46	5 × 5 × ·48
84 „ 87	·42	$6\frac{1}{2}$ × 3 × ·40	24 × ·40	$3\frac{1}{2}$ × $3\frac{1}{2}$ × ·48	5 × 5 × ·52	$3\frac{1}{2}$ × $3\frac{1}{2}$ × ·48	5 × 5 × ·50
87 „ 90	·42	$6\frac{1}{2}$ × 3 × ·40	24 × ·40	$3\frac{1}{2}$ × $3\frac{1}{2}$ × ·50	5 × 5 × ·52	$3\frac{1}{2}$ × $3\frac{1}{2}$ × ·50	5 × 5 × ·50
90 „ 93	·44	$6\frac{1}{2}$ × 3 × ·40	25 × ·40	4 × 4 × ·52	6 × 6 × ·52	$3\frac{1}{2}$ × $3\frac{1}{2}$ × ·50	5 × 5 × ·50
93 „ 96	·44	$6\frac{1}{2}$ × 3 × ·40	25 × ·40	4 × 4 × ·54	6 × 6 × ·54	$3\frac{1}{2}$ × $3\frac{1}{2}$ × ·50	5 × 5 × ·50
96 „ 99	·44	$6\frac{1}{2}$ × 3 × ·40	26 × ·40	4 × 4 × ·56	6 × 6 × ·56	$3\frac{1}{2}$ × $3\frac{1}{2}$ × ·50	5 × 5 × ·52

ASSIGNMENT OF FREEBOARD.

Under the Merchant Shipping Act, 1894, the Committee of Lloyd's Register are empowered to assign freeboards to British Vessels as required by the Act. Forms of application for the assignment of freeboard can be obtained from the London, or other, offices of the Society.

The mode of Marking, approved by the Board of Trade, is as follows:—

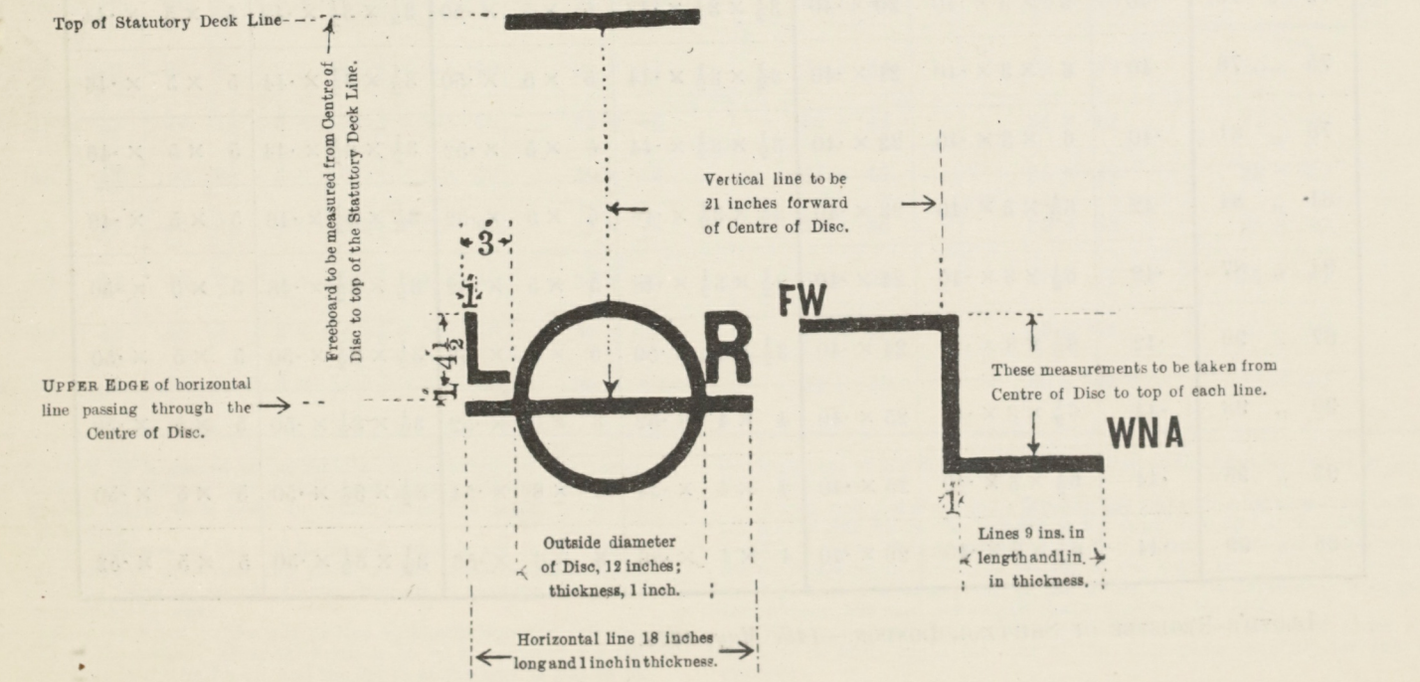
FREEBOARD MARKING FOR STEAMERS.



The Centre of Disc to be placed on both sides of vessel amidships, *i.e.*, at the middle of the length of the load water line. Vessels are to be marked with such of the horizontal lines as are applicable to the nature of their employment. In accordance with the Regulations made by the Board of Trade, the discs and lines must be permanently marked by centre punch marks or cutting, and the particulars given in the Certificate are to be entered in the official log.

N.B.—It is a condition on which an awning or shelter deck or partial awning deck vessel is classed in the Society's Register Book that the Freeboard assigned shall be marked on the vessel's sides as above prescribed; and, under the provisions of Section 44 of the Society's Rules for Steel Ships. If the vessel proceed to sea with a less freeboard than that approved by the Committee, or if the freeboard mark be placed higher than the position assigned by the Committee, the vessel will be liable to have her class expunged from the Register Book.

FREEBOARD MARKING FOR SAILING VESSELS.



The Centre of Disc to be placed on both sides of vessel amidships, *i.e.*, at the middle of the length of the load line. Coasting vessels are required to be marked with only the maximum load line in fresh water In accordance with the regulations made by the Board of Trade, the disc and lines must be permanently marked by centre punch marks or cutting, and the particulars given in the Certificate are to be entered in the official log.